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ABSTRACT

This curriculum for a 1-semester or 1-year course in product design and planning contains information about the following topics: creativity, idea production techniques, problem solving, design fundamentals, design requirements, graphic communication, materials and processes, and safety. Course content is organized around the laboratory activities necessary to design and produce products. Some of the topics covered include the following: introduction to design; orthographic drawing, sketching, and dimensioning; graphic design; design in wood, plastic, and metal; individual project construction; and idea production techniques and cognitive-creative abilities. The guide contains competencies (task lists), student competency records, and management sheets. Management sheets, which serve as lesson outlines covering 1 or more days, include the following: an introduction, the performance objective, a task/competency statement, an equipment and supplies list, a performance standard, suggested references for teacher and student, activities, and evaluation criteria. Appendixes have the the following contents: definitions; course outlines; supplies and equipment lists; a suggested facility layout; information on creativity, pencil rendering techniques, ink rendering techniques, design requirements, human factors, design principles, the design process, idea production techniques, and cognitive creative abilities; sample design problems; a sample copyright form; evaluation criteria; and a 25-item bibliography. (KC)

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Curriculum Guide
for
Technology Education
Manufactured Product Design and Planning

Developed by
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for

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Office of Vocational Education

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MANUFACTURED PRODUCT DESIGN AND PLANNING

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS v

INTRODUCTION vii

COMPETENCY LIST xi

STUDENT COMPETENCY RECORD. xv

MANAGEMENT SHEETS 1

APPENDICIES

A. Definition of Terms 123

B. Course Outline 125

C. Overall Tool and Equipment List 133

D. Overall Supply List 135

E. Bibliography 137

F. Suggested Facility Layout 139

G. Definition of Design Terms 141

H. The Importance of Design and Creativity 145

I. How Do You Develop Creative Ability 147

J. Pencil Rendering Techniques 149

K. Ink Rendering Techniques 155

L. Design Requirements 159

M. Human Factors (Anthropometrics) 161

N. Design Principles 165

O. The Design Process 167

P. Idea Production Techniques 177

Q. Cognitive Creative Abilities 181

R. Example Design Problems I and II 183

S. Sample Copyright Form 207

T. Design Problems 211

U. Evaluation 353

V. Footnotes 355

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INTRODUCTION

This instructional guide was developed to help the teacher and student to become more informed about product design and planning. This guide contains information concerning creativity and imagination, idea production techniques, a problem solving process, design fundamentals and design requirements. Also included is information concerning graphic communication, materials and processes, safety procedures, structured design problems, and individual and mass production projects.

The overall objectives of this instructional guide are to help teach the students skills in design and planning, skills in graphic communications, a better understanding of materials and processes, problem solving skills through planned and structured design experiences and hopefully develop an appreciation, awareness and sensitivity to design.

The materials presented here are intended for both male and female students who are enrolled in an 18 or 36 week course in technology education. An * will be placed on the competency list that will indicate information and materials that could be covered in an 18 week class. Students may find this course beneficial if they are interested in pursuing possible careers in business and industry or using these fundamental skills in furthering their education in vocational schools or college.

This information and the problems which follow have been developed to help you design creatively. In the past the subject of creativity and design have been neglected because they are not understood by the average person. Unlike math and science, creativity and design are not usually taught in the schools and thus the student's exposure is very limited. In today's modern world every convenience we have we must contribute to the design and creativity that individuals have used to develop products and solve particular problems. Design can be found everywhere and in everything whether it be manmade or a product of nature. Most people feel insecure in the area of creativity and design because they do not understand the basic concepts; they have never been asked to be creative and they have had no formal instruction. Research supports the fact that creativity dwells in every educable person; it only needs to be cultivated and exercised with planned and systematic experiences.

The project approach has been used for many years in industrial arts as a means to teach basic concepts and skills. When a student completes a project for a particular class, many assume that the design as well as the construction was planned and executed by the student. In most instances this is not entirely true. The students did perform the machine or hand operations necessary for its construction but very few actually design their project. Too often the student finds a particular product in a magazine or catalogue that is appealing and immediately proceeds to copy the design. No attempt is made to modify the visual appearance of the design. Even the construction techniques are left the same because the student assumes they are the most sound and efficient. This situation occurs because the students feel their design ability is inadequate and will not venture upon the simplest design task. There is nothing wrong with using an existing design as a guide. To the contrary, a beginning student should be encouraged to explore the realm of existing designs. However, they should not neglect to incorporate their own ideas of how to improve upon the beauty, construction and function of that design. When the students actually incorporate their own ideas of how to improve upon the beauty, construction and function of that design; when the students actually incorporate their own creative ability in the planning and construction of a project, the learning experience, self-satisfaction and the feeling of accomplishment will be enhanced and the total level of instruction strengthened. Teaching and learning design is not easy. There are few textbook answers. In many cases there are no right or wrong solutions. There are as many solutions as there are individuals. Design and creative thinking can be taught through structured and well planned experiences, thus the creation of this instructional guide.

MANUFACTURED PRODUCT DESIGN & PLANNING

COMPETENCIES

Introduction to Design

*MPD 001. Define the following terms: design, creativity, imagination, problem solving and product design.

*MPD 002. Explain the importance of design and creativity.

*MPD 003. Explain how persons can develop their imagination and creative potential.

Orthographic Drawing, Sketching and Dimensioning

*MPD 004. Explain the use of basic drafting equipment and machines.

*MPD 005. Demonstrate correct lettering techniques.

*MPD 006. Identify measurements and drawing scale with an architect's scale.

*MPD 007. Identify and draw the alphabet of lines.

*MPD 008. Demonstrate correct sketching techniques.

*MPD 009. Sketch orthographic views.

*MPD 010. Dimension orthographic views.

*MPD 011. Draw and dimension orthographic views with instruments.

Pictorial Drawing, Sketching and Rendering

*MPD 012. Sketch and draw an isometric pictorial.

MPD 013. Sketch and draw an oblique pictorial.

MPD 014. Sketch and draw a two point perspective.

*MPD 015. Draw and render a pictorial drawing with graphite pencil.

MPD 016. Draw orthographic and pictorial views in ink and dimension the orthographic views.

NOTE: *REPRESENTS COMPETENCIES COVERED IN AN 18 WEEK CLASS.

MPD 017. Demonstrate ink rendering techniques.

MPD 018. Render an isometric pictorial in ink line shading and stipple.

MPD 019. Render a pictorial drawing with color pencils.

Design Requirements

*MPD 020. Describe the functional, material and visual requirements of a product design.

*MPD 021. Identify the human factors (anthropometrics) in product design.

Design Principles

*MPD 022. Explain the following design principles: unity, balance, proportion, harmony and rhythm.

The Design Process

*MPD 023. Define the steps of a problem solving process.

Idea Production Techniques and Cognitive Creative Abilities

*MPD 024. Describe the following idea-production techniques: association, partial design, redesign, use of basic shapes, scribble, forced relationships, bionics, checklisting, and brainstorming.

*MPD 025. Describe the following cognitive creative abilities: fluency, flexibility, originality and elaboration.

Example Design Problems I and II

*MPD 026. Identify the design process and the idea-production techniques used to organize and develop ideas in the example design problems I and II.

Graphic Design

*MPD 027. Define the following graphic arts terms: camera-ready copy, off-set printing, silkscreen printing, layout and design and type styles.

*MPD 028. Define a copyright.

*MPD 029. Work a graphic design problem and use the design process and idea-production techniques to organize idea development.

*MPD 030. Draw the final graphic design solution in ink and render with color pencil.

Design in Wood

*MPD 031. Identify different kinds of wood.

*MPD 032. Identify safety rules and regulations.

*MPD 033. Identify the following methods of forming or shaping wood: cutting drilling, sculpturing, sanding and turning.

*MPD 034. Identify different ways of joining woods.

*MPD 035. Explain wood finishing.

*MPD 036. Define a "patent".

*MPD 037. Design a product in wood and use the design process and idea-producing techniques to organize idea development.

*MPD 038. Draw the final design solution orthographically and add dimensions.

*MPD 039. Draw the final design solution in isometric and render in pencil.

*MPD 040. Develop a parts-material list and a plan of construction for the product design in wood.

Design in Plastic

MPD 041. Describe the following ways of forming plastic: injection molds, extrusion, casting and vacuum forming.

MPD 042. Identify the following methods in construction when working with sheet acrylic: bending, cutting, adhesives, jointing and finishing.

MPD 043. Design a product in acrylic and use the design process and the idea-producing techniques to organize idea development.

MPD 044. Draw the final design solution in orthographic and add dimensions.

MPD 045. Draw the final design solution in two point perspective and render in pencil.

MPD 046. Develop a parts-material list and a plan of construction for the product design in plastic.

Design in Metal

MPD 047. Identify different kinds and standard configurations of metal stock.

MPD 048. Identify the following methods of forming metals: cutting, casting, forging, bending, boring and turning.

MPD 049. Identify the different ways of fastening metal parts.

MPD 050. Identify the different ways of finishing metals.

MPD 051. Design a product using metal as the construction material and use the design process and idea production techniques to organize idea development.

MPD 052. Draw the final design solution in orthographic and add dimensions.

MPD 053. Draw the final design solution in oblique cabinet and render in ink stipple and line shading.

MPD 054. Develop a parts-material list and a plan of construction for the product design in metal.

Individual Project Construction

*MPD 055. Define the following terms as they relate to product design: model, mock-up, prototype.

*MPD 056. Construct a prototype of one of the designs that has been developed.

Group Mass Production Project

*MPD 057. Participate in the planning and construction of a class mass-production project.

STUDENT COMPETENCY RECORD

School____________________
Student____________________
School Year____________________
Instructor's Name____________________
Course Title Manufactured Product Design & Planning
Classification____________________

Student Address____________________
____________________ ________
Zip

Comments____________________

The student should be evaluated according to the performance ratings listed. Indicate on this form the numeric rating of the student's performance for each item.

(1) Competency in Process
(2) Competency Performed with Close Supervision
(3) Competency Performed with Limited Supervision
(4) Competency Performed without Supervision

COMPETENCIES

*NOTE: *REPRESENTS COMPETENCIES COVERED IN AN 18-WEEK CLASS.

	*MPD 001.	Define the following terms: design, creativity, imagination, problem solving and product design.
	*MPD 002.	Explain the importance of design and creativity.
	*MPD 003.	Explain how persons can develop their imagination and creative potential.
	*MPD 004.	Explain the use of basic drafting equipment and machines.
	*MPD 005.	Demonstrate correct lettering techniques.
	*MPD 006.	Identify measurements and drawing scale with an architect's scale.
	*MPD 007.	Identify and draw the alphabet of lines.
	*MPD 008.	Demonstrate correct sketching techniques.
	*MPD 009.	Sketch orthographic views.
	*MPD 010.	Dimension orthographic views.
	*MPD 011.	Draw and dimension orthographic views with instruments.
	*MPD 012.	Sketch and draw an isometric pictorial.
	MPD 013.	Sketch and draw an oblique pictorial.

	MPD 014.	Sketch and draw a two-point perspective.
	*MPD 015.	Draw and render a pictorial drawing with graphite pencil.
	MPD 016.	Draw orthographic and pictorial views in ink and dimension the orthographic views.
	MPD 017.	Demonstrate ink-rendering techniques.
	MPD 018.	Render an isometric pictorial in ink-line shading and stipple.
	MPD 019.	Render a pictorial drawing with color pencils.
	*MPD 020.	Describe the functional, material and visual requirements of a product design.
	*MPD 021.	Identify the human factors (anthropometrics) in product design.
	*MPD 022.	Explain the following design, principles: unity, balance, proportion, harmony and rhythm.
	*MPD 023.	Define the steps of a problem-solving process.
	*MPD 024.	Describe the following idea-production techniques: association, partial design, redesign, use of basic shapes, scribble, forced relationships,

		bionics, checklisting, and brainstorming.
	*MPD 025.	Describe the following cognitive creative abilities: fluency, flexibility, originality and elaboration.
	*MPD 026.	Identify the design process and the idea-production techniques used to organize and develop ideas in the example design problems I and II.
	*MPD 027.	Define the following graphic arts terms: camera-ready copy, off-set printing, silkscreen printing, layout and design and type styles.
	*MPD 028.	Define a copyright.
	*MPD 029.	Work a graphic design problem and sue the design process and idea-production techniques to organize idea development.
	*MPD 030.	Draw the final graphic design solution in ink and render with color pencil.
	*MPD 031.	Identify different kinds of wood.
	*MPD 032.	Identify safety rules and regulations.
	*MPD 033.	Identify the following methods of forming or shaping wood: cutting, drilling, sculpturing, sanding and turning.
	*MPD 034.	Identify different ways of joining woods.
	*MPD 035.	Explain wood finishing.
	*MPD 036.	Define a "patent".
	*MPD 037.	Design a product in wood and use the design process and idea-producing techniques to organize idea development.
	*MPD 038.	Draw the final design solution orthographically and add dimensions.

	*MPD 039.	Draw the final design solution in isometric and render in pencil.
	*MPD 040.	Develop a parts-material list and a plan of construction for the product design in wood.
	MPD 041.	Describe the following ways of forming plastic: injection molds, extrusion, casting and vacuum forming.
	MPD 042.	Identify the following methods in construction when working with sheet acrylic: bending, cutting, adhesives, jointing and finishing.
	MPD 043.	Design a product in acrylic and use the design process and the idea-producing techniques to organize idea development.
	MPD 044.	Draw the final design solution in orthographic and add dimensions.
	MPD 045.	Draw the final design solution in two-point perspective and render in pencil.
	MPD 046.	Develop a parts-material list and a plan of construction for the product design in plastic.
	MPD 047.	Identify different kinds and standard configurations of metal stock.
	MPD 048.	Identify the following methods of forming metals: cutting, casting, forging, bending, boring and turning.
	MPD 049.	Identify the different ways of fastening metal parts.
	MPD 050.	Identify the different ways of finishing metals.
	MPD 051.	Design a product using metal as th construction material and use the design process and idea-production techniques to organize idea

development.

MPD 052. Draw the final design solution in orthographic and add dimensions.

MPD 053. Draw the final design solution in oblique cabinet and render in ink stipple and line shading.

MPD 054. Develop a parts-materials list and a plan of construction for the product design in metal.

*MPD 055. Define the following terms as they relate to product design: model, mock-up, prototype.

*MPD 056. Construct a prototype of one of the designs that has been developed.

*MPD 057. Participate in the planning and construction of a class mass-production project.

MANAGEMENT SHEETS

INTRODUCTION TO DESIGN

INTRODUCTION: To fully understand the basic concepts of product design you must first be able to define what certain design terms are and how they relate to each other.

PERFORMANCE OBJECTIVE (2 Days)

TASK/COMPETENCY: 001. Define the following terms: design, creativity, imagination, problem solving and product design.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Define in writing each term given in Appendix G. All important points should be stated.

ENABLING OBJECTIVE Read and study the definitions concerning design and creativity.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Appendix G.	a. Appendix G.
b. Webster's Dictionary.	b. Webster's Dictionary.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Design and the Individual." Career Aids, Inc.

Film -- "Creative Attitude." General Motors Corporation, 3044 West
Grand Blvd., Detroit, MI 48202.

ACTIVITIES 001

TEACHER	STUDENT
1. Run copies of Appendix G and hand out to the students.	1. Read and study the definitions in Appendix G.
2. Have the students read and study the definitions in Appendix G.	2. Define in writing each of the terms related to design.
3. Show the audiovisual and discuss with the class what each definition means and how they relate to each other.	

EVALUATION CRITERIA: The teacher will review each student's responses for content and accuracy and will apply a numerical value.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 002. Explain the importance of design and creativity.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Explain in writing the importance of design and creativity. All major points should be stated as explained in Appendix H.

ENABLING OBJECTIVE Define design and creativity.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix H.	1. Recommended a. Appendix H.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "A Product of the Imagination." Aluminum Company of America, 794 Alcoa Building, Pittsburgh, PA 15219.

Film -- "Stylist." Ford Motor Company, Motion Picture Department, The American Road, Dearborn, MI 48123.

Film -- "The Designmakers." Ford Motor Company, Motion Picture Department, The American Road, Dearborn, MI 48123.

ACTIVITIES 002

TEACHER	STUDENT
1. Run copies of Appendix H and hand out to the students. 2. Have the students read and study Appendix H. 3. Show the audiovisuals and discuss with the class why design and creativity are important.	1. Read and study Appendix H. 2. Explain in writing why design and creativity are important.

EVALUATION CRITERIA: The teacher will review each student's responses in regard to accuracy and content and will apply a numerical value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 003. Explain how persons can develop their imagination and creative potential.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: List seven of ten ways to develop imagination and creativity as given in Appendix I.

ENABLING OBJECTIVE Define imagination and creative potential.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix I.	1. Recommended a. Appendix I.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Product Development." Visual Aids Service, University of Illinois, Champaign, IL 61820.

ACTIVITIES 003

TEACHER	STUDENT
1. Run copies of Appendix I and hand out to the students. 2. Have the students read and study Appendix I. 3. Show the audiovisual and discuss with the class how imagination and creativity can be developed.	1. Read and study Appendix I. 2. Explain in writing how imagination and creativity can be developed.

EVALUATION CRITERIA: The teacher will review each student's responses in regard to content and accuracy and will apply a numerical value.

INTRODUCTION: Product designers must be able to convey their design ideas and concepts. The most effective way to communicate their ideas is in a graphic form. The ability to draw, sketch and dimension is one of the designers' most valuable tools.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 004. Explain the use of basic drafting equipment and machines.

EQUIPMENT AND SUPPLIES: 1/4" grid paper, tracing paper, French curve, triangles, protractor, drawing pencils, sketching pencils, circle template, ellipse template, bar compass, dividers, eraser, drafting tape, T-square, architect's scale.

STANDARD OF PERFORMANCE: Identify twelve of fifteen pieces of drafting equipment displayed by the instructor.

ENABLING OBJECTIVE Define and differentiate drafting equipment and supplies.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment." French, Svenson, Helsel, Urbanick. McGraw-Hill Book Company.	1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment." French, Svenson, Helsel, Urbanick. McGraw-Hill Book Company.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Basic Drafting." Career Aids, Inc.

Video -- "Drafting/Mechanical Drawing." Vocational Media Association.

ACTIVITIES 004

TEACHER	STUDENT
1. Have students read Chapter 3, "Use and Care of Drafting Equipment," in recommended text. 2. Display and identify drafting equipment and supplies. 3. Provide students with a list of necessary equipment and supplies. 4. Show one of the audiovisuals or demonstrate the use of the drafting equipment and supplies.	1. Read Chapter 3, "Use and Care of Drafting Equipment," in recommended text. 2. Identify drafting equipment and supplies. 3. Practice the use of the various types of drafting equipment on a blank piece of paper.

EVALUATION CRITERIA: The teacher will ask the students to identify, in writing, the various drafting supplies and equipment. Assign a numerical value.

INTRODUCTION: A product designer must be able to communicate in writing. The use of correct and established lettering practices are essential in establishing professional drawings.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 005. Demonstrate correct lettering techniques.

EQUIPMENT AND SUPPLIES: Lettering exercise on ruled line paper, 2H or H drafting pencil.

STANDARD OF PERFORMANCE: Execute correct lettering practices with 70% accuracy according to the evaluation criteria and the examples given in the recommended text.

ENABLING OBJECTIVE Reproduce correct lettering styles and practice.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 2, "Sketching and Lettering." Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 2, "Sketching and Lettering." Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 005

TEACHER	STUDENT
1. Have the students read Chapter 2, "Sketching and Lettering", in recommended text. 2. Demonstrate correct lettering procedure on chalkboard.	1. Read Chapter 2, "Sketching and Lettering", in recommended text. 2. Practice lettering, using the correct style and technique.

EVALUATION CRITERIA: Performance will be evaluated according to the instructor's rating scale, which would include:

1. Correct style.
2. Line quality.
3. Overall lettering appearance and quality.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 006. Identify measurements and drawing scale with an architect's scale.

EQUIPMENT AND SUPPLIES: Architect's scale, paper, 2H drafting pencil and teacher handouts.

STANDARD OF PERFORMANCE: Measure pre-drawn lines within 1/16 of an inch accuracy.

ENABLING OBJECTIVE Read an architect's scale.

REFERENCES

TEACHER	STUDENT
1. Recommended a. *Mechanical Drawing*, Chapter 3, "Use and Care of Drafting Equipment." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. *Basic Drafting Problems*, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. *Mechanical Drawing*, Chapter 3, "Use and Care of Drafting Equipment." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. *Basic Drafting Problems*, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 006

TEACHER	STUDENT
1. Have students read Chapter 3, "Use and Care of Drafting Equipment", pages 62-66, in recommended text.	1. Read Chapter 3, "Use and Care of Drafting Equipment", pages 62-66, in recommended text.
2. Review the use of the architect's scale with the class.	2. Measure the lines on the sheet of paper and record their lengths. Use a full scale.
3. Provide the student with a sheet with pre-drawn lines of various lengths.	3. Measure the same lines using a half scale.
	4. Measure the same lines using 1/4" scale.

EVALUATION CRITERIA: Lines must be measured within 1/16" accuracy.

INTRODUCTION: Drafting skill is a very important tool for the designer. To develop this skill, the designer must use established drafting practices in line quality to create professional-looking drawings.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 007. Identify and draw the alphabet of lines.

EQUIPMENT AND SUPPLIES: T-square, paper, eraser, triangles, tape and H, 2H, 4H drafting pencils.

STANDARD OF PERFORMANCE: Reproduce each type of drafting line with 70% accuracy according to the evaluation criteria and the examples in the recommended text.

ENABLING OBJECTIVE Reproduce the different lines used in drafting.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 007

TEACHER	STUDENT
1. Have the students read Chapter 3, "Use and Care of Drafting Equipment", pages 55-62, in recommended text. 2. Review Chapter 3 and the alphabet of lines with the class. 3. Demonstrate correct line quality and methodology.	1. Read Chapter 3, "Use and Care of Drafting Equipment", pages 55-62, in recommended text. 2. Draw the alphabet of lines using correct drafting practices.

EVALUATION CRITERIA: Performance will be evaluated according to the instructor's rating scale, which would include:

1. Line quality.
2. Line weight.
3. Overall appearance.

. PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 008. Demonstrate correct sketching techniques.

EQUIPMENT AND SUPPLIES: H or HB sketching pencil, grid paper, eraser.

STANDARD OF PERFORMANCE: Sketch a teacher-selected object with 70% accuracy according to the evaluation criteria.

ENABLING OBJECTIVE Reproduce correct sketching procedures.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 2, "Sketching and Lettering." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.	1. Recommended a. Mechanical Drawing, Chapter 2, "Sketching and Lettering." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.

ACTIVITIES 008

TEACHER	STUDENT
1. Have the students read Chapter 2, "Sketching and Lettering", in recommended text, pages 24-41.	1. Read Chapter 2, "Sketching and Lettering", in recommended text, pages 24-41.
2. Demonstrate sketching procedures and methodology.	2. Sketch the given problem.
3. Provide the students with sketching exercises.	

EVALUATION CRITERIA: Performance will be evaluated according to the instructor's rating scale, which would include:

1. Line quality.
2. Proportion.
3. Accuracy.
4. Visual appearance.

ORTHOGRAPHIC DRAWING, SKETCHING AND DIMENSIONING

INTRODUCTION: Orthographic projection or multiview drawing, is one of the most important areas in graphic communication. An understanding of these principles is essential and must be stressed repeatedly.

PERFORMANCE OBJECTIVE (1 - 3 Days)

TASK/COMPETENCY: 009. Sketch orthographic views.

EQUIPMENT AND SUPPLIES: H or HB drafting pencils, grid paper, eraser.

STANDARD OF PERFORMANCE: Sketch three views with 70% accuracy according to the evaluation criteria.

ENABLING OBJECTIVE Identify the principles of orthographic projection.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Mechanical Drawing, Chapter 5, "Multiview Drawing". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.	a. Mechanical Drawing, Chapter 5, "Multiview Drawing". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.
2. Suggested	2. Suggested
a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 009

TEACHER	STUDENT
1. Have the students read Chapter 5, "Multiview Drawing", in recommended text.	1. Read Chapter 5, "Multiview Drawing", in recommended text.
2. Demonstrate and review orthographic projection principles and procedures.	2. Sketch assigned orthographic problems.
3. Use visual aids.	
4. Have the students sketch selected orthographic problems.	

EVALUATION CRITERIA: Instructor's rating scale:

1. Correct sketching practices.
2. Correct orthographic view, development and arrangement.
3. Neatness and accuracy of lines.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 010. Dimension orthographic views.

EQUIPMENT AND SUPPLIES: 2H, 4H drafting pencil, grid paper, eraser.

STANDARD OF PERFORMANCE: Dimensioning should be with 70% accuracy according to the evaluation criteria and evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the correct dimensioning practices and fundamentals.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. *Mechanical Drawing,* Chapter 6, "Dimensioning". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.	a. *Mechanical Drawing,* Chapter 6, "Dimensioning". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.
2. Suggested	2. Suggested
a. *Basic Drafting Problems,* Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	a. *Basic Drafting Problems,* Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 010

TEACHER	STUDENT
1. Have the students read Chapter 6, "Dimensioning", in assigned text.	1. Read Chapter 6, "Dimensioning", in recommended text.
2. Review and demonstrate correct dimensioning practices.	2. Dimension assigned orthographic views.
3. Have students dimension orthographic views.	

EVALUATION CRITERIA: Instructor's rating scale:
1. Correct sketching practices.
2. Correct dimensioning practices.
3. Line quality.
4. Neatness and accuracy.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 011. Draw and dimension orthographic views with instruments.

EQUIPMENT AND SUPPLIES: T-square, drafting pencils, eraser, tape, architect's scale, triangles, circle and template.

STANDARD OF PERFORMANCE: Draw and dimension assigned problem with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Identify correct drafting and dimensioning practices.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment", Chapter 4, "Geometry for Technical Drawing", Chapter 5, "Multiview Drawing", and Chapter 6 "Dimensioning." French Svensen, Helsel, Urbanick McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 3, "Use and Care of Drafting Equipment", Chapter 4, "Geometry for Technical Drawing", Chapter 5, "Multiview Drawing", and Chapter 6 "Dimensioning." French Svensen, Helsel, Urbanick McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 011

TEACHER	STUDENT
1. Have the students review Chapter 3, "Use and Care of Drafting Equipment", Chapter 4, "Geometry for Technical Drawing", Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." 2. Demonstrate correct drafting and dimensioning practices. 3. Have the students draw and dimension orthographic views with instruments.	1. Review Chapter 3, "Use and Care of Drafting Equipment", Chapter 4, "Geometry for Technical Drawing", Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." 2. Draw and dimension assigned orthographic views with instruments.

EVALUATION CRITERIA: Instructor's rating scale:
1. Correct drafting practices.
2. Correct dimensioning practices.
3. Neatness and accuracy.
4. Overall quality.

INTRODUCTION: Pictorial drawing, sketching and rendering play a very important role in product design. This form of graphic communication is used by the designer to develop ideas and to communicate those ideas to others.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 012. Sketch and draw an isometric pictorial.

EQUIPMENT AND SUPPLIES: T-square, drafting pencils, sketching pencil, triangles, ellipse template, tape, eraser, architect's scale, paper.

STANDARD OF PERFORMANCE: Sketch and draw assigned problem with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the fundamentals of an isometric projection drawing.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Design Graphics, Leslie Martin. The Macmillan Company. b. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration". French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Design Graphics, Leslie Martin. The Macmillan Company. b. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 012

TEACHER	STUDENT
1. Have the students read Chapter 12, "Pictorial Drawing-Technical Illustration", in the recommended text.	1. Have the students read Chapter 12, "Pictorial Drawing-Technical Illustration", in the recommended text.
2. Review and demonstrate isometric projection fundamentals.	2. Sketch an isometric pictorial of a given object.
3. Have the students sketch an isometric pictorial of a given object.	3. Draw with instruments an isometric pictorial of the given object.
4. Have the students draw the isometric pictorial with instruments.	

EVALUATION CRITERIA: Instructor's rating scale:

1. Correct sketching practices.
2. Correct drawing practices.
3. Correct isometric projection principles.
4. Neatness and accuracy.
5. Overall quality.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 013. Sketch and draw an oblique pictorial.

EQUIPMENT AND SUPPLIES: T-square, drafting pencils, sketching pencil, triangles, circle template, tape, eraser, architect's scale.

STANDARD OF PERFORMANCE: Sketch and draw assigned problem with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the fundamentals of an oblique drawing.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 12," Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 013

TEACHER	STUDENT
1. Have the students read Chapter 12, "Pictorial Drawing-Technical Illustration", in the recommended text. 2. Review and demonstrate oblique projection fundamentals with the class. 3. Have the students sketch an oblique pictorial of a given object. 4. Have the students draw the oblique pictorial with instruments.	1. Read Chapter 12, "Pictorial Drawing-Technical Illustration", in the recommended text. 2. Sketch an oblique pictorial of a given object. 3. Draw with instruments an oblique pictorial of the given object.

EVALUATION CRITERIA: Instructor's rating scale:

1. Correct sketching practices.
2. Correct drawing practices.
3. Correct oblique projection principles.
4. Neatness and accuracy.
5. Overall quality.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 014. Sketch and draw a two-point perspective.

EQUIPMENT AND SUPPLIES: T-square, drafting pencils, sketching pencils, triangles, tape, eraser, architect's scale, 11 X 17 paper.

STANDARD OF PERFORMANCE: Sketch and draw assigned problem with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the fundamentals of a two-point perspective drawing.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.	1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Basic Drafting Problems, Student Workbook, Lawrence Gerevas. Glencoe Publishing Company.

ACTIVITIES 014

TEACHER	STUDENT
1. Have the students read Chapter 12, "Pictorial Drawing-Technical Illustration", in recommended text, pages 283-290.	1. Read Chapter 12, "Pictorial Drawing-Technical Illustration", in recommended text, pages 283-290.
2. Review and demonstrate two-point perspective drawing with the class.	2. Sketch a two-point perspective of a given object.
3. Have the students sketch a two-point perspective of a given object.	3. Draw with instruments a two-point perspective of the given object.
4. Have the students draw a two-point perspective of the object.	

EVALUATION CRITERIA: Instructor's rating scale:

1. Correct sketching practices.
2. Correct drawing practices.
3. Correct two point perspective principles.
4. Neatness and accuracy.

INTRODUCTION: When a product design is developed, the designers will try to present their ideas in a realistic manner. Pencil rendering is a simple method used to make a design appear realistic and natural.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 015. Draw and render a pictorial drawing with graphite pencil.

EQUIPMENT AND SUPPLIES: Standard drafting equipment, HB, 2B drafting pencils, cold press Bristol board.

STANDARD OF PERFORMANCE: Rendering should be done with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce pictorial drawing fundamentals and graphite-rendering fundamentals.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. b. Appendix J, Pencil Rendering Techniques.	1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration". French, Svensen, Helsel, Urbanick. McGraw-Hill Company. b. Appendix J, Pencil Rendering Techniques.
2. Suggested a. Design Graphics, Leslie Martin. The Macmillan Company. b. Architectural Illustration The Value Delineation Process, Paul Stevenson Oles. Van Nostrand Reinhold Company.	2. Suggested a. Design Graphics, Leslie Martin. The Macmillan Company. b. Architectural Illustration The Value Delineation Process, Paul Stevenson Oles. Van Nostrand Reinhold Company.

c. Architectural Illustration, Leavitt Dudley. Prentice-Hall, Inc.

d. Rendering With Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.

e. Architectural Rendering Techniques and Color Reference, Mike Lin. Van Nostrand Reinhold Company.

f. Technical Illustration, James Bethune. John Wiley and Sons Book Company.

g. Perspective Sketches, Theodore Walker. PDA Publishers Corp.

c. Architectural Illustration, Leavitt Dudley. Prentice-Hall, Inc.

d. Rendering With Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.

e. Architectural Rendering Techniques and Color Reference, Mike Lin. Van Nostrand Reinhold Company.

f. Technical Illustration, James Bethune. John Wiley and Sons Book Company.

g. Perspective Sketches, Theodore Walker. PDA Publishers Corp.

ACTIVITIES 015

TEACHER	STUDENT
1. Have the students read Chapter 12, "Pictorial Drawing-Technical Illustration", pages 293-299, in recommended text.	1. Read Chapter 12, "Pictorial Drawing-Technical Illustration", pages 293-299, in recommended text.
2. Review suggested textbooks.	2. Work the rendering exercise supplied by the instructor.
3. Review and demonstrate graphite-rendering techniques that are listed in Appendix J.	3. Draw and render a pictorial drawing in graphite pencil.
4. Have students work the rendering exercises in Appendix J.	
5. Have the students draw a pictorial drawing.	
6. Have the students render the pictorial with graphite pencil.	

EVALUATION CRITERIA: Instructor's rating scale for drawing:
1. Correct drawing techniques.
2. Accuracy.

Instructor's rating scale for pencil rendering which includes:
1. Even tones.
2. Clean, sharp edges.
3. Neatness.
4. Good blending of tones.
5. Overall effect of rendering.
6. Contrast of light and dark tones.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 016. Draw orthographic and pictorial views in ink and dimension the orthographic views.

EQUIPMENT AND SUPPLIES: Technical drawing pen, 11 X 17 hot press Bristol board or tracing paper, drafting equipment.

STANDARD OF PERFORMANCE: Drawing should be executed with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce drafting fundamentals and ink drawing requirements.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 13, "Inking." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Rendering With Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.	1. Recommended a. Mechanical Drawing, Chapter 13, "Inking." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. Rendering With Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.

ACTIVITIES 016

TEACHER	STUDENT
1. Have the students read Chapter 13, "Inking", in recommended text. 2. Review and demonstrate ink drawing procedures. 3. Have the students draw in ink orthographic and pictorial views of a previously drawn object. 4. Have the students dimension the orthographic views.	1. Read Chapter 13, "Inking", in recommended text. 2. Draw in ink orthographic and pictorial views. 3. Dimension the orthographic views in ink.

EVALUATION CRITERIA: Instructor's rating scale:
1. Correct drafting practices.
2. Correct dimensioning practices.
3. Line quality.
4. Neatness and accuracy.
5. Overall quality.

INTRODUCTION: Ink rendering is another method used to present a design concept and to make this idea appear realistic and natural. There are a variety of techniques using ink to create a certain visual effect.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 017. Demonstrate ink-rendering techniques.

EQUIPMENT AND SUPPLIES: Technical ink pen, drafting equipment, paper.

STANDARD OF PERFORMANCE: Rendering should be executed with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the various ink-rendering techniques.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.	a. Mechanical Drawing, Chapter 12, "Pictorial Drawing-Technical Illustration." French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company.
b. Appendix K, Ink-Rendering Techniques.	b. Appendix K, Ink-Rendering Techniques.
2. Suggested	2. Suggested
a. Rendering with Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.	a. Rendering with Pen and Ink, Robert Gill. Van Nostrand Reinhold Company.
b. Guide for Patent Draftsmen, Booklet distributed by the U.S. Department of Commerce, Patent and Trademark Office.	b. Guide for Patent Draftsmen, Booklet distributed by the U.S. Department of Commerce, Patent and Trademark Office.
c. Rendering in Pen and Ink, Arthur Guptill. Watson-Guptill Publications.	c. Rendering in Pen and Ink, Arthur Guptill. Watson-Guptill Publications.

ACTIVITIES 017

TEACHER	STUDENT
1. Have the students review Chapter 12, "Pictorial Drawing-Technical Illustration", pages 293-299, in recommended text. 2. Have students review the recommended references. 3. Review and demonstrate ink-rendering techniques with the class. 4. Have the students work the exercise in Appendix K.	1. Review Chapter 12, "Pictorial Drawing-Technical Illustration", pages 293-299, in recommended text. 2. Review recommended references. 3. Work the ink-rendering exercise supplied by the instructor.

EVALUATION CRITERIA: Instructor's rating scale:

1. Line quality.
2. Neatness and accuracy.
3. Overall quality of drawing.
4. Correct rendering techniques.
5. Proper use of light.
6. Good contrast between light and dark areas.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 018. Render an isometric pictorial in ink-line shading and stipple.

EQUIPMENT AND SUPPLIES: Technical ink pen, drafting equipment, tracing paper or hot press Bristol board.

STANDARD OF PERFORMANCE: Rendering should be developed with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce the ink rendering techniques, line shading and stipple.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. b. Appendix K, Ink-Rendering Techniques. 2. Suggested a. Rendering with Pen and Ink, Robert Gill. Van Nostrand Reinhold Company. b. Guide for Patent Draftsmen, Booklet distributed by the U.S. Department of Commerce, Patent and Trademark Office.	1. Recommended a. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. b. Appendix K, Ink-Rendering Techniques. 2. Suggested a. Rendering with Pen and Ink, Robert Gill. Van Nostrand Reinhold Company. b. Guide for Patent Draftsmen, Booklet distributed by the U.S. Department of Commerce, Patent and Trademark Office.

ACTIVITIES 018

TEACHER	STUDENT
1. Have the students review recommended references. 2. Review and demonstrate ink-rendering techniques, line shading and stipple with the students. 3. Have the students render an isometric drawing in ink using line shading and stipple-rendering techniques.	1. Review recommended references. 2. Render an isometric drawing in ink using line shading and stipple-rendering techniques.

EVALUATION CRITERIA: Instructor's rating scale:
1. Correct drafting practices.
2. Neatness and accuracy.
3. Rendering technology.
4. Proper use of light.
5. Overall quality of drawing.
6. Good contrast between light and dark areas.

INTRODUCTION: Adding color to a drawing will enhance its realism and make it appear more natural. Many of the same techniques used in graphite rendering can be used in color pencil work.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 019. Render a pictorial drawing with color pencils.

EQUIPMENT AND SUPPLIES: Set of color pencils, drafting equipment, cold press Bristol board or Strathmore paper.

STANDARD OF PERFORMANCE: Rendering should be developed with 70% accuracy according to the evaluation criteria and the evaluation scale in Appendix U.

ENABLING OBJECTIVE Reproduce pencil-rendering techniques.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. The Color Pencil Key Concepts of Handling the Medium, Bet Borgeson. Watson-Guptill Publications. b. Appendix J, Pencil-Rendering Techniques.	1. Recommended a. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. 2. Suggested a. The Color Pencil Key Concepts of Handling the Medium, Bet Borgeson. Watson-Guptill Publications. b. Appendix J, Pencil-Rendering Techniques.

ACTIVITIES 019

TEACHER	STUDENT
1. Have the students review the recommended text and materials. 2. Review and demonstrate color pencil-rendering techniques. 3. Have the students render a pictorial drawing in color pencil.	1. Review recommended references. 2. Render a pictorial drawing in color pencils.

EVALUATION CRITERIA: Instructor's rating scale:

1. Drawing technique and accuracy.
2. Even blending of tones.
3. Clean, sharp edges.
4. Contrast of light and dark areas.
5. Overall effect of rendering.

DESIGN REQUIREMENTS

INTRODUCTION: For a product design to be a meaningful contribution to society, it must satisfy three basic requirements. These requirements are: function, material and visual. The product designer must research and study these areas to achieve a successful design solution.

PERFORMANCE OBJECTIVE (1/2 Day)

TASK/COMPETENCY: 020. Describe the function, material and visual requirements of a product design.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Describe in writing the three design requirements as presented in Appendix L with 90% accuracy.

ENABLING OBJECTIVE Identify the three requirements of a product design.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix L, Design Requirements.	1. Recommended a. Appendix L, Design Requirements.

ACTIVITIES 020

TEACHER	STUDENT
1. Have the students review Appendix L, Design Requirements.	1. Review Appendix L, Design Requirements.
2. Review with the class Appendix L.	2. Define in writing the design requirements.
3. Have the students define in writing the design requirements.	

EVALUATION CRITERIA: Descriptions should be to the satisfaction of the instructor with a point distribution applied.

DESIGN REQUIREMENTS

INTRODUCTION: To design for people, the designer must know what sizes and dimensions to specify for a particular design. This information regarding the size of the average human body is called anthropometrics.

PERFORMANCE OBJECTIVE (1/2 Day)

TASK/COMPETENCY: 021. Detect the human factors (anthropometrics) in product design.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Define the anthropometrics as stated in the introduction with 100% accuracy and be familiar with what it involves.

ENABLING OBJECTIVE Identify what anthropometrics is and what it involves.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix M, Human Factors. 2. Suggested a. The Measure of Man: Human Factors in Design, Henry Dreyfuss. Whitney Library of Design.	1. Recommended a. Appendix M, Human Factors. 2. Suggested a. The Measure of Man: Human Factors in Design, Henry Dreyfuss. Whitney Library of Design.

ACTIVITIES 021

TEACHER	STUDENT
1. Have students review Appendix M, Human Factors. 2. Review with the class how anthropometrics (measurements of the human body) relate to product design. 3. Have the students describe in writing anthropometrics.	1. Review Appendix M, Human Factors. 2. Describe in writing the human factors involved in product design.

EVALUATION CRITERIA: Description should be to the satisfaction of the instructor with a point value applied.

PERFORMANCE OBJECTIVE (1/2 Day)

TASK/COMPETENCY: 022. Explain the following: design principles, unity, balance, proportion, harmony and rhythm.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Correctly define four of the five terms given in Appendix N.

ENABLING OBJECTIVE Differentiate between the design principles, unity, balance, proportion, harmony and rhythm.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix N, Design Principles.	1. Recommended a. Appendix N, Design Principles.

ACTIVITIES 022

TEACHER	STUDENT
1. Have the students read Appendix N, Design Principles. 2. Review the design principles with the class. 3. Have the students define the design principles in writing.	1. Read Appendix N, Design Principles. 2. Define the design principles in writing.

EVALUATION CRITERIA: Definitions should be to the satisfaction of the instructor, with a point distribution applied.

THE DESIGN PROCESS

INTRODUCTION: In a structured problem-solving situation there must be some plan of attack, some structured way of developing, organizing and analyzing design concepts and ideas. The design process will help the designer to systematically work through a design task.

PERFORMANCE OBJECTIVE (2 Days)

TASK/COMPETENCY: 023. Define the steps of a problem-solving process.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: List and define the seven steps of the design process with 70% accuracy as stated in Appendix O.

ENABLING OBJECTIVE Repeat the steps in the problem-solving process.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix O, The Design Process. b. *Manufacturing: A Basic Text,* Foles, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.	1. Recommended a. Appendix O, The Design Process. b. *Manufacturing: A Basic Text,* Foles, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.

ACTIVITIES 023

TEACHER	STUDENT
1. Have the students read and study Appendix O, The Design Process.	1. Read and study Appendix O, The Design Process.
2. Have the students read Chapter 7, "Designing and Engineering Products", in the recommended text.	2. Read Chapter 7, "Designing and Engineering Products", in the recommended text.
3. Review the design process (design analysis method) with the class.	3. Define in writing the steps of the design process.
4. Demonstrate each area of the design process, using an example product to be designed as a guide.	
5. Have the students define the design process.	

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Apply a point value.

IDEA-PRODUCTION TECHNIQUES AND COGNITIVE-CREATIVE ABILITIES

INTRODUCTION: The designer must be able to generate ideas and then transform those ideas into workable solutions. To help in their idea development, the designer could use several proven methods which help generate ideas.

PERFORMANCE OBJECTIVE (2 DAYS)

TASK/COMPETENCY: 024. Describe the following idea-production techniques: association, basic shapes, scribble, brain storming, forced relationships, partial design, redesign, check-listing, bionics, and synectics.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Define correctly eight of ten idea-production techniques presented in Appendix P.

ENABLING OBJECTIVE Differentiate between the different idea-production techniques.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix P, Idea-Production Techniques.	1. Recommended a. Appendix P, Idea-Production Techniques.

ACTIVITIES 024

TEACHER	STUDENT
1. Have the students read Appendix P, Idea-Production Techniques.	1. Read and study Appendix P, Idea Production-Techniques.
2. Review the idea-production techniques with the class.	2. Define each idea-production technique in writing.
3. Demonstrate each technique and use examples of each.	
4. Have the students define each idea production technique in writing.	

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

INTRODUCTION: To evaluate idea production by the student is very difficult and subjective, to a degree, as stated earlier. There are no textbook answers and no right or wrong answers, but there are creative abilities that can be measured to some degree. They are: fluency, flexibility, originality and elaboration.

PERFORMANCE OBJECTIVE (1/2 Day)

TASK/COMPETENCY: 025. Describe the following cognitive-creative abilities; fluency, flexibility, originality and elaboration.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Define the four cognitive-creative abilities as stated in Appendix Q with 90% accuracy.

ENABLING OBJECTIVE Identify the cognitive-creative abilities.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix Q, Cognitive Creative Abilities.	1. Recommended a. Appendix Q, Cognitive Creative Abilities.

ACTIVITIES 025

TEACHER	STUDENT
1. Have the students read and study Appendix Q, Cognitive-Creative Abilities. 2. Review the cognitive-creative abilities with the class and explain how each relates to idea development. 3. Have the students define in writing each cognitive creative ability.	1. Read and study Appendix Q, Cognitive-Creative Abilities. 2. Define in writing each cognitive creative ability.

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

EXAMPLE DESIGN PROBLEMS I and II

INTRODUCTION: It is sound educational philosophy that if a person sees a task done along with learning the fundamentals, the learners will grasp the overall concept and will be able to execute that task on their own.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 026. Identify the design process and the idea-production techniques used to organize and develop ideas in the example design problems I and II.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: List the seven steps of the design process and state the idea-production techniques used in developing a design solution.

ENABLING OBJECTIVE Reproduce the design process and idea-production techniques.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix R, Example Design Problems I & II. 2. Suggested a. Race Car, Teacher's Manual and Student Workbook, Boyd Hanks. Quest Publishing Co. Distributed by Pitsco, Inc., Box 1328, Pittsburg, KS 66762.	1. Recommended a. Appendix R, Example Design Problems I & II. 2. Suggested Race Car, Teacher's Manual and Student Workbook, Boyd Hanks. Quest Publishing Co. Distributed by Pitsco, Inc., Box 1328, Pittsburg, KS 66762.

ACTIVITIES 026

TEACHER	STUDENT
1. Have the students review Appendix R, Example Design Problems I & II.	1. Review and study Appendix R, Example Design Problems I & II.
2. Review with the class the Example Problem (Appendix R). Pay particular attention to the design process and how the idea-production techniques were used.	2. Review the Example Design Problem in regard to design process and idea-production techniques.
3. Review each stage of the design process using the example problem as a guide.	3. Note how fluency, flexibility, originality and elaboration are involved in the design sketches.
4. Review how the cognitive-creative abilities are used: fluency, flexibility, originality, and elaboration.	

EVALUATION CRITERIA: To the satisfaction of the instructor. A point value will be applied.

INTRODUCTION: In graphic design, the designer is arranging words, letters, shapes, colors and format in a way that will communicate and convey a message in graphic form.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 027. Define the following graphic arts terms: camera ready copy, off-set printing, silk screen printing, layout and design and type styles.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Properly define four of the five graphic arts terms.

ENABLING OBJECTIVE Identify the terms related to graphic arts.

REFERENCES

TEACHER	STUDENT
1. Suggested a. Introduction to Photo-Offset Lithography, Kenneth F. Hird. Bennett and McKnight Publishing Co. b. Screen Process Printing, Robert Banzhaf. Bennett and McKnight Publishing Co.	1. Suggested a. Introduction to Photo-Offset Lithography, Kenneth F. Hird. Bennett and McKnight Publishing Co. b. Screen Process Printing, Robert Banzhaf. Bennett and McKnight Publishing Co.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Offset Lithography." Bennett & McKnight.

Film -- "Screen Process Printing." Bennett & McKnight.

ACTIVITIES 027

TEACHER	STUDENT
1. Show the audiovisuals and/or review and explain each graphic arts term and show how they relate to graphic design. 2. Have the students define in writing the graphic arts terms.	1. Define the graphic arts terms in writing.

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 028. Define a copyright.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: List seven of nine steps used in applying for a copyright as shown in Appendix S.

ENABLING OBJECTIVE Identify the legal protection given written or graphic information.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix S, Sample Copyright Form. 2. Suggested a. Copyright Information Packet, from Register of Copyrights, Library of Congress, Washington, DC 20559.	1. Recommended a. Appendix S, Sample Copyright Form. 2. Suggested a. Copyright Information Packet, from Register of Copyrights, Library of Congress, Washington, DC 20559.

ACTIVITIES 028

TEACHER	STUDENT
1. Have the students read and study copyright form in Appendix S. 2. Review and explain the information related to a copyright. 3. Have the students define in writing a copyright.	1. Read and study copyright form in Appendix S. 2. Define in writing a copyright.

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 029. Work a graphic design problem and use the design process and idea-production techniques to organize idea development.

EQUIPMENT AND SUPPLIES: Graphic design problem, teacher handouts.

STANDARD OF PERFORMANCE: Work the graphic design problem with 70% accuracy according to the evaluation sheet in Appendix U and the guidelines presented in Appendix O and Appendix P.

ENABLING OBJECTIVE Apply the design process, idea-production techniques and graphic arts terms.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Appendix R, Problem II.	Appendix R, Problem II.
2. Suggested	2. Suggested
a. Zipatone Catalog or Equal, Zipatone, Inc.	a. Zipatone Catalog or Equal, Zipatone, Inc.
b. Trademarks and Symbols Volume I and II, Yasabouro Kuwayama. Van Nostrand Reinhold Co.	b. Trademarks and Symbols Volume I and II, Yasabouro Kuwayama. Van Nostrand Reinhold Co.
c. Trademarks: A Handbook of International Designs, Peter Wildbur. Van Nostrand Reinhold Co.	c. Trademarks: A Handbook of International Designs, Peter Wildbur. Van Nostrand Reinhold Co.
d. Packaging, Packungen, Emballages Graphics, Walter Herdeg. Hastings House Publishers.	d. Packaging, Packungen, Emballages Graphics, Walter Herdeg. Hastings House Publishers.
e. NOAH, Rockport Publishers.	e. NOAH, Rockport Publishers.

f. World Trademarks and Logotypes, Takenobu Igarashi. Graphic-sha Publishing Co.	f. World Trademarks and Logotypes, Takenobu Igarashi. Graphic-sha Publishing Co.
g. Techniques For Producing Visual Instructional Media, Minor and Frye. McGraw-Hill Book Co.	g. Techniques For Producing Visual Instructional Media, Minor and Frye. McGraw-Hill Book Co.
h. Advertising Graphics, H. William Bockus, Jr. McMillan Publishing Co.	h. Advertising Graphics, H. William Bockus, Jr. McMillan Publishing Co.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Graphic Arts Design." Bennett & McKnight.

ACTIVITIES 029

TEACHER	STUDENT
1. Have the students review, read and study Appendix R, Problem II.	1. Read and review Appendix R, Problem II.
2. Assign a graphic design problem.	2. Work the graphic design problem using the design process and idea-production techniques in sketching possible and refined ideas.
3. Show the audiovisual and/or review the design process as it relates to the graphic design problems.	3. Choose and draw a final design in pencil.
4. Review the idea production techniques and how they relate to the problem.	
5. Have the students sketch possible and refined solutions to the problem.	
6. Have the students choose and draw their final design in pencil.	

EVALUATION CRITERIA: Use fluency, flexibility, originality and elaboration to evaluate idea development and execution. Have a point value for each.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 030. Draw the final graphic design solution in ink and render with color pencil.

EQUIPMENT AND SUPPLIES: Ink pen, hot press, Bristol board, drafting equipment, drymount letter or stencil, color pencils, tape and eraser.

STANDARD OF PERFORMANCE: Draw and render the final design presentation with 70% accuracy according to the evalution sheet in Appendix U.

ENABLING OBJECTIVE Apply drawing and rendering techniques and the use of drymount letters.

REFERENCES

TEACHER	STUDENT
1. Suggested a. Zipatone Catalog or Equal, Zipatone, Inc. b. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. c. The Color Pencil Key Concepts of Handling the Medium, Bet Borgeson. Watson Guptill Publications.	1. Suggested a. Zipatone Catalog or Equal, Zipatone, Inc. b. Mechanical Drawing, French, Svensen, Helsel, Urbanick. McGraw-Hill Book Company. c. The Color Pencil Key Concepts of Handling the Medium, Bet Borgeson. Watson Guptill Publications.

ACTIVITIES 030

TEACHER	STUDENT
1. Have the students draw their final design orthographicly and in ink. The drawing should be on hot press Bristol board or good quality paper. 2. Demonstrate the use of drymount letters (Zipatone or Equal). 3. Review the use of the ink pen and color pencils.	1. Draw the final design in ink and on good quality paper. 2. Apply drymount letters as they relate to your design. 3. Render the final design with color pencils.

EVALUATION CRITERIA: Correct and accurate drafting and rendering principles and overall effectiveness of presentation. Assign a point value.

INTRODUCTION: For a product designer to be effective, just being creative and imaginative is not enough. The designer must know some technical information concerning the different kinds of materials and how those materials work with various machine processes.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 031. Identify different kinds of wood.

EQUIPMENT AND SUPPLIES: Wood samples.

STANDARD OF PERFORMANCE: Properly identify eight of ten wood samples displayed by the instructor.

ENABLING OBJECTIVE Compare the various kinds of woods.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.	1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.

ACTIVITIES 031

TEACHER	STUDENT
1. Have the students read Topic 26, "Woods", in recommended text.	1. Read Topic 26, "Woods", in the recommended text.
2. Have the students study the chart on page 412.	2. Read and study the chart on page 412.
3. Review the various types of woods with the class, showing examples of each.	3. Identify in writing the various kinds of wood.
4. Have the students identify in writing the various kinds of wood.	

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 032. Identify safety rules and regulations.

EQUIPMENT AND SUPPLIES: Teacher Handout (Safety Rules).

STANDARD OF PERFORMANCE: List the proper safety rules and regulations with 100% accuracy on a teacher made test.

ENABLING OBJECTIVE Apply correct safety rules and regulations.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. *Manufacturing: A Basic Text,* Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.	a. *Manufacturing: A Basic Text,* Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.
2. Suggested	2. Suggested
a. *Wood Working for Industry,* John Feirer. Chas. A. Bennett Co.	a. *Wood Working for Industry,* John Feirer. Chas. A. Bennett Co.

SELECTED INSTRUCTIONAL MATERIALS:

Video -- "Safety In Woodworking." Vocational Media Association.

Film -- "Shop Safety Series." Career Aids, Inc.

ACTIVITIES 032

TEACHER	STUDENT
1. Have the students read Chapter 4, "Workers and Safety", pages 52-59, 305, 317, 322-324, 326, 330, 333, 349, 354, 357, 359-360, 363, 365-367, 374, 379-380, 384, 395, 407 and 444, in recommended text.	1. Read Chapter 4, "Workers and Safety", pages 52-59, 305, 317, 322-324, 326, 330, 333, 349, 354, 357, 359-360, 363, 365-67, 374, 379-380, 384, 395, 407 and 444, in recommended text.
2. Show the audiovisual and or review safety rules and regulations with the class.	2. Take a safety test.
3. Demonstrate correct safety practices to the class.	
4. Administer a safety test.	

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 033. Identify the following methods of forming or shaping wood: cutting, drilling, sculpting, sanding and turning.

EQUIPMENT AND SUPPLIES: Hand tools, woodworking equipment, sanding supplies and wood.

STANDARD OF PERFORMANCE: Properly identify five methods of shaping wood with 70% accuracy as stated in the recommended text.

ENABLING OBJECTIVE Apply woodworking tools and equipment information.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.	1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.

SELECTED INSTRUCTIONAL MATERIALS:

VHS Video -- "Practical Woodworking Series." Career Aids, Inc.

ACTIVITIES 033

TEACHER	STUDENT
1. Have the student read Topic 5, Sawing; Topic 6, Drilling and Boring; Topic 7, Wood Planing, Shaping and Turning; and Topic 15, Filing and Sanding, in recommended text. 2. Show the audiovisual and/or review and demonstrate each operation with the class. 3. Review safety rules and procedures with the class. 4. Have each student practice each operation.	1. Read Topics 5, 6, 7 and 15, in the recommended text. 2. Review the safety rules and regulations. 3. Practice each woodworking operation.

EVALUATION CRITERIA: Instructor's rating in regard to correct identifiction of the methods of forming or shaping wood. Assign a point value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 034. Identify the different ways of joining woods.

EQUIPMENT AND SUPPLIES: Wood joint samples, teacher handouts.

STANDARD OF PERFORMANCE: Properly name eight of ten wood joints displayed by the instructor.

ENABLING OBJECTIVE Apply wood joints, adhesives, clamping and other methods of fastening information.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.	a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company.
2. Suggested	2. Suggested
a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.	a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.

ACTIVITIES 034

TEACHER	STUDENT
1. Have the students read Topic 11, Glues, Cements and Other Adhesives and Topic 24, Clamping, in recommended text.	1. Read and study Topic 11, Glues, Cements and Other Adhesives and Topic 24, Clamping, in recommended text.
2. Review and demonstrate joining methods and procedures.	2. Identify wood joints.
3. Have the students identify in writing joining methods and procedures.	

EVALUATION CRITERIA: Instructor's rating in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 035. Explain wood finishing.

EQUIPMENT AND SUPPLIES: Wood finish examples.

STANDARD OF PERFORMANCE: Properly identify four of six examples of wood finishes.

ENABLING OBJECTIVE Detect the properties of and the kinds of wood.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.	1. Recommended a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. 2. Suggested a. Wood Working for Industry, John Feirer. Chas. A. Bennett Co.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Finishing." Career Aids, Inc.

ACTIVITIES 035

TEACHER	STUDENT
1. Have the students read Topic 23, Finishing, in recommended text. 2. Show the audiovisual and/or review wood finishing with the class. 3. Show examples to the class. 4. Have the students identify the wood finishes.	1. Read Topic 23, Finishing, in recommended text. 2. Identify wood finishes.

EVALUATION CRITERIA: Instructor's rating in regard to accuracy and content. Assign a point value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 036. Define a patent.

EQUIPMENT AND SUPPLIES: Teacher Handout.

STANDARD OF PERFORMANCE: Define in writing a "patent" with 90% accuracy on a teacher made test.

ENABLING OBJECTIVE Identify the legal protection given new inventions.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. Pages 170-171.	a. Manufacturing: A Basic Text, Fales, Sheets, Mervich, Dinan. Bennett & McKnight Publishing Company. Pages 170-171.
2. Suggested	2. Suggested
a. Rules of Practice in Patent Cases. Free booklet from U.S. Patent Office, Department of Commerce, Washington, DC.	a. Rules of Practice in Patent Cases. Free booklet from U.S. Patent Office, Department of Commerce, Washington, DC.
b. General Information Concerning Patents. Free booklet from U.S. Patent Office, Department of Commerce, Washington, DC.	b. General Information Concerning Patents. Free booklet from U.S. Patent Office, Department of Commerce Washington, DC.
c. Guide for Patent Draftsmen. Free booklet from U.S. Patent Office, Department of Commerce, Washington, DC.	c. Guide for Patent Draftsmen. Free booklet from U.S. Patent Office, Department of Commerce, Washington, DC.

ACTIVITIES 036

TEACHER	STUDENT
1. Have the students read "Patents", page 170, in recommended text. 2. Review "Patents" with the class. 3. Have the students define in writing, a "Patent."	1. Read "Patents" on page 170, in text. 2. Define in writing a "Patent."

EVALUATION CRITERIA: Instructor's rating in regard to accuracy and content. Assign a point value.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 037. Design a product in wood and use the design process and idea-production techniques to organize idea development.

EQUIPMENT AND SUPPLIES: Design problem in wood, teacher handouts.

STANDARD OF PERFORMANCE: Work the design problem in wood with 70% accuracy according to the evaluation sheet in Appendix U, and the information presented in Appendix O and Appendix P.

ENABLING OBJECTIVE Apply the design process, idea-production techniques, sketching techniques and basic information concerning woods.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Appendix R, Example Problems I and II. b. Appendix O, The Design Process. c. Appendix P, Idea-Production Techniques. d. Manufacturing: A Basic Text. Chapter 7, "Designing and Engineering Products", pages 87-102.	1. Recommended a. Appendix R, Example Problems I and II. b. Appendix O, The Design Process. c. Appendix P, Idea-Production Techniques. d. Manufacturing: A Basic Text. Chapter 7, "Designing and Engineering Products", pages 87-102.

SELECTED INSTRUCTIONAL MATERIALS:

Sound/Film -- "Furniture Design Fundamentals." Vocational Media Assoc.

ACTIVITIES 037

TEACHER	STUDENT
1. Have the students review and read Appendix R, Example Problems I and II. Appendix O, Design Process. Appendix P, Idea-Production Techniques and Chapter 7, "Designing and Engineering", in recommended text. 2. Review Appendices R, O, and P, with the students. 3. Show the audiovisual. 4. Show examples of products in wood and discuss each in regard to design and construction. 5. Review Chapter 7, "Designing and Engineering Products", with the students. 6. Review the design problem and have the students sketch possible, refined and final solutions to the wood design problem.	1. Read and study Appendix R, Example Problems I and II. Appendix O, Design Process. Appendix P, Idea-Production Techniques and Chapter 7, "Designing and Engineering Products", in recommended text. 2. Work the design problem in wood, using the design process, and idea production techniques in sketching possible, refined and final solutions to the problem.

EVALUATION CRITERIA: Use the creative abilities, fluency, flexibility, originality and elaboration to evaluate the design sketches. Assign a point value for each.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 038. Draw the final design solution orthographically and add dimensions.

EQUIPMENT AND SUPPLIES: Drafting equipment, drawing pencils H, 4H and 11 X 17 paper.

STANDARD OF PERFORMANCE: Drawings should be executed with 70% accuracy.

ENABLING OBJECTIVE Apply the principles of orthographic projection, correct dimensioning standards and drafting practices.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapters 5 and 6. b. Manufacturing: A Basic Text, Topic 1.	1. Recommended a. Mechanical Drawing, Chapters 5 and 6. b. Manufacturing: A Basic Text, Topic 1.

ACTIVITIES 038

TEACHER	STUDENT
1. Have the students review drafting and dimensioning practices in the recommended texts. 2. Review drafting and dimensioning practices with the class. 3. Have the students develop an orthographic drawing of their final design and then add dimensions. Position the drawing on one half of the 11 X 17 paper.	1. Review correct drafting and dimensioning practices in the recommended texts. 2. Draw the final design in orthographic and add dimensions. Position the drawing on one half of the 11 X 17 paper.

EVALUATION CRITERIA: Instructor's evaluation of correct drafting and dimensioning practices. Assign a point value for each.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 039. Draw the final design solution in isometric and render in pencil.

EQUIPMENT AND SUPPLIES: 11 X 17 paper, drafting equipment, and rendering pencils.

STANDARD OF PERFORMANCE: Draw and render the final design presentation with 70% accuracy according to the evaluation sheet in Appendix U.

ENABLING OBJECTIVE Apply isometric drafting principles and pencil-rendering fundamentals.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing". b. Appendix J, Pencil-Rendering Techniques.	1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing". b. Appendix J, Pencil-Rendering Techniques.

ACTIVITIES 039

TEACHER	STUDENT
1. Have the students review Chapter 12, "Pictorial Drawing", in recommended text.	1. Review Chapter 12 in recommended text.
2. Have the students review Appendix J, Pencil Rendering.	2. Review Appendix J, Pencil Rendering.
3. Review isometric drawing and rendering practices with the class.	3. Draw the final design solution in isometric, on the other half of the 11 X 17 paper on which the orthographic is drawn.
4. Have the students draw their final design in an isometric pictorial on the other half of the 11 X 17 paper on which the orthographic is drawn.	4. Render the isometric pictorial in pencil.
5. Have the students render the isometric pictorial in pencil.	

EVALUATION CRITERIA: Instructor's evaluation in regard to correct drafting and rendering practices. Assign a point value for each.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 040. Develop a parts-material list and a plan of construction for the product design in wood.

EQUIPMENT AND SUPPLIES: Teacher handout, example forms.

STANDARD OF PERFORMANCE: Complete a parts-material list and plan of construction for the design problem in wood. All parts and materials that would be needed for construction should be included. All construction procedures should be correctly indicated.

ENABLING OBJECTIVE Apply basic wood working tools and equipment, and basic wood working procedures.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, pages 60-68, Understanding Production Plans and Unit IV, Production Plans.	1. Recommended a. Manufacturing: A Basic Text, pages 60-68, Understanding Production Plans and Unit IV, Production Plans.

ACTIVITIES 040

TEACHER	STUDENT
1. Have the students read and study pages 60-68, Understanding Production Plans. 2. Have the students read and study Unit IV, Production Plans, in the recommended text. 3. Review with the class the parts list and plan for construction in the recommended text. 4. Have the students develop a parts list and a construction plan for their final design in wood.	1. Read and study pages 60-68, Understanding Production Plans. 2. Read and study Unit IV in the recommended text. 3. Develop a parts list and a plan of construction for your final design in wood. Use the examples in the text as a guide.

EVALUATION CRITERIA: Instructor's evaluation in regard to accuracy and correct procedure. Assign a point value for each.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 041. Describe the following ways of forming plastic: injection molds, extrusion, casting, and vacuum forming.

EQUIPMENT AND SUPPLIES: Examples of formed plastics.

STANDARD OF PERFORMANCE: Describe in writing four methods of forming plastic with 70% accuracy on a teacher made test.

ENABLING OBJECTIVE Differentiate among the different methods of forming plastics.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Manufacturing: A Basic Text, Topic 20, Casting, Molding, and Forming.	a. Manufacturing: A Basic Text, Topic 20, Casting, Molding, and Forming.
2. Suggested	2. Suggested
a. Exploring The World of Plastics, Gerald L. Steele. Bennett and McKnight Publishing Company.	a. Exploring The World of Plastics, Gerald L. Steele. Bennett and McKnight Publishing Company.
b. General Plastics Projects and Procedures, Raymond Cherry. Bennett and McKnight Publishing Company.	b. General Plastics Projects and Procedures, Raymond Cherry. Bennett and McKnight Publishing Company.

ACTIVITIES 041

TEACHER	STUDENT
1. Have the students read Topic 20, Casting, Molding, and Forming, in recommended text.	1. Read Topic 20, Casting, Molding, and Forming, in recommended text.
2. Review the various ways of forming plastics with the class. Show examples of each.	2. Describe in writing the various ways of forming plastics.
3. Have the students define in writing the various ways of forming plastics.	

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value for each.

DESIGN IN PLASTIC

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 042. Identify the following methods in construction when working with sheet acrylic: bending, cutting, adhesives, jointing and finishing.

STANDARD OF PERFORMANCE: Describe the four methods of construction with 70% accuracy on a teacher made test.

ENABLING OBJECTIVE Differentiate between methods of construction.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Manufacturing: A Basic Text, Topic 28, Plastics.	a. Manufacturing: A Basic Text, Topic 28, Plastics.
2. Suggested	2. Suggested
a. Exploring The World of Plastics, Gerald L. Steele. Bennett and McKnight Publishing Company.	a. Exploring The World of Plastics, Gerald L. Steele. Bennett and McKnight Publishing Company.
b. General Plastics Projects and Procedures, Raymond Cherry. Bennett and McKnight Publishing Company.	b. General Plastics Projects and Procedures, Raymond Cherry. Bennett and McKnight Publishing Company.
c. The World of Acrylics, (Multi-media package). ROHM and HAAS Educational Services.	c. The World of Acrylics, (Multi-media package). ROHM and HAAS Educational Services.

ACTIVITIES 042

TEACHER	STUDENT
1. Have the students read Topic 28, Plastics, in the recommended text.	1. Read Topic 28, Plastics, in the recommended text.
2. Have the student review Topic 5, Sawing, Topic 6, Drilling and Forming, Topic 11, Glues, Cements and Other Adhesives, Topic 15, Filing, Sanding and Polishing.	2. Read and review Topics 5, 6, 11 and 15, in the recommended text.
3. Review and demonstrate methods in construction with the class.	3. Identify in writing the construction methods used in working with sheet acrylic.
4. Review safety rules.	
5. Have the students identify in writing the construction methods used in working with sheet acrylic.	

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value for each.

DESIGN IN PLASTIC

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 043. Design a product in acrylic and use the design process and the idea-production techniques to organize idea development.

EQUIPMENT AND SUPPLIES: Design Problem, Teacher Handouts.

STANDARD OF PERFORMANCE: Work the design problem in wood with 70% accuracy according to the evaluation sheet in Appendix U, and the guidelines presented in Appendix O and Appendix P.

ENABLING OBJECTIVE Apply the design process, idea-production techniques and basic information concerning acrylics.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Appendix R, Example Problems I and II.	a. Appendix R, Example Problems I and II.
b. Appendix O, The Design Process.	b. Appendix O, The Design Process.
c. Appendix P, Idea-Production Techniques.	c. Appendix P, Idea-Production Techniques.
d. Manufacturing: A Basic Text, Chapter 7, "Designing and Engineering Products", pages 87-102.	d. Manufacturing: A Basic Text, Chapter 7, "Designing and Engineering Products", pages 87-102.

ACTIVITIES 043

TEACHER	STUDENT
1. Have the students review Appendix R, Example Problems I and II, Appendix O, Design Process, Appendix P, Idea-Production Techniques, and Chapter 7, "Designing and Engineering Products", in recommended text.	1. Review Appendix R, Example Problems I and II, Appendix O, Design Process, Appendix P, Idea-Production Techniques and Chapter 7, "Designing and Engineering Products", in recommended text.
2. Review Appendices R, O, and P with the students.	2. Work the design problem in acrylic, using the design process and idea-production techniques in sketching possible, refined, and final solutions to the problem.
3. Show examples of products in acrylic and discuss each in relation to design and construction.	
4. Review the design problem and have the students sketch possible, refined and final solutions to the acrylic design problem.	

EVALUATION CRITERIA: Use the creative abilities, fluency, flexibility, originality and elaboration to evaluate the design sketches. Assign a point value for each.

DESIGN IN PLASTIC

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 044. Draw the final design solution in orthographic and add dimensions.

EQUIPMENT AND SUPPLIES: Drafting equipment, drawing pencils H, 4H and 11 X 17 paper.

STANDARD OF PERFORMANCE: Draw and dimension the final design presentation with 70% accuracy according to the evaluation sheet in Appendix U and the evaluation criteria.

ENABLING OBJECTIVE Apply the principles of orthographic projection, correct dimensioning and drafting standards.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." b. Manufacturing: A Basic Text, Topic 1.	1. Recommended a. Mechanical Drawing, Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." b. Manufacturing: A Basic Text, Topic 1.

ACTIVITIES 044

TEACHER	STUDENT
1. Have the students review orthographic drafting and dimensioning practices, in the recommended text.	1. Review correct drafting and dimensioning practices in the recommended text.
2. Review drafting and dimensioning practices, if needed.	2. Draw the final design in orthographic and add dimensions. Position the drawing on one half of the 11 X 17 paper.
3. Have the students develop an orthographic drawing of their final design and then add dimensions. Position the orthographic drawing on one half of the 11 X 17 paper.	

EVALUATION CRITERIA: Instructor's evaluation of correct drafting and dimensioning practices. Assign a point value.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 045. Draw the final design solution in two-point perspective and render in pencil.

EQUIPMENT AND SUPPLIES: Drafting equipment, drawing pencils, rendering pencils and 11 X 17 paper.

STANDARD OF PERFORMANCE: Draw and render the final design presentation with 70% accuracy according to the evaluation criteria and the evaluation sheet in Appendix U.

ENABLING OBJECTIVE Reproduce perspective drawing fundamentals and pencil-rendering fundamentals.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, pages 282-290, "Two-Point Perspective." b. Appendix J, Pencil-Rendering Techniques.	1. Recommended a. Mechanical Drawing, Chapter 12, pages 282-290, "Two-Point Perspective." b. Appendix J, Pencil-Rendering Techniques.

ACTIVITIES 045

TEACHER	STUDENT
1. Have the students review Chapter 12, pages 282-290, "Two-Point Perspective", in recommended text.	1. Review Chapter 12, pages 282-290, "Two-Point Perspective", in recommended text.
2. Have the students review Appendix J, Pencil-Rendering Techniques.	2. Review Appendix J, Pencil-Rendering Techniques.
3. Demonstrate two-point perspective drawing to the class.	3. Draw a two-point perspective of the final design on a 11 X 17 piece of paper.
4. Demonstrate pencil rendering to the class.	4. Transfer the perspective pictorial to the other half of the 11 X 17 paper on which the orthographic was drawn.
5. Have the students draw and render the perspective on the other half of the 11 X 17 paper on which the orthographic was drawn.	5. Render the perspective in pencil.

EVALUATION CRITERIA: Drawing should be evaluated on:

1. Correct drafting practices.
2. Line values.
3. Neatness and accuracy.

Rendering should be evaluated on:

1. Proper blending of tones.
2. Good contrast between light and dark areas.
3. Clean sharp edges.
4. Proper use of the light source.
5. Neatness

A point value can be applied to each.

DESIGN IN PLASTIC

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 046. Develop a parts-material list and a plan of construction for the product design in plastic.

EQUIPMENT AND SUPPLIES: Teacher handout, blank forms.

STANDARD OF PERFORMANCE: Complete a parts-material list and a plan of construction for the design problem in acrylic. All parts and materials needed for the constructing of the project should be included. All construction procedures should be correctly indicated.

ENABLING OBJECTIVE Apply basic information concerning tools and equipment and basic information concerning plastics.

REFERENCES

TEACHER	STUDENT
1. Recommended a. *Manufacturing: A Basic Text,* pages 60-68, Understanding Production Plans and Unit IV, Production Plans.	1. Recommended a. *Manufacturing: A Basic Text,* pages 60-68, Understanding Production Plans and Unit IV, Production Plans.

ACTIVITIES 046

TEACHER	STUDENT
1. Have the students review pages 60-68, Understanding Production Plans.	1. Review pages 60-68, Understanding Production Plans.
2. Have the students review Unit IV, Production Plans, in recommended text.	2. Review Unit IV, Production Plans, in recommended text.
3. Review with the class the parts list and plan of construction in the recommended text.	3. Develop a parts list and plan of construction for your final design in plastic. Use the examples in the text as a guide.
4. Have the students develop a parts list and construction plan for their final design in plastic.	

EVALUATION CRITERIA: Instructor's evaluation in regard to accuracy and correct procedures. Assign a point value.

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 047. Identify different kinds and standard configurations of metal stock.

EQUIPMENT AND SUPPLIES: Metal samples, teacher handout.

STANDARD OF PERFORMANCE: Properly identify in writing eight of ten standard configurations of metals and identify four of six kinds of metals.

ENABLING OBJECTIVE Differentiate among different metals and standard configurations.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Topic 27, Metals. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.	1. Recommended a. Manufacturing: A Basic Text, Topic 27, Metals. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.

ACTIVITIES 047

TEACHER	STUDENT
1. Have the students read Topic 27, Metals, in recommended text. 2. Review Topic 27 with the class. 3. Have the students identify in writing the kinds and configurations of the different metals.	1. Read Topic 27, Metals, in recommended text. 2. Identify in writing the kinds and configurations of the different metals.

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 048. Identify the following methods of forming metals: cutting, casting, forging, bending, boring and turning.

EQUIPMENT AND SUPPLIES: Teacher handout, examples of formed metals.

STANDARD OF PERFORMANCE: Correctly identify in writing five of seven methods of forming metals as stated in the recommended text.

ENABLING OBJECTIVE Differentiate among different methods of forming metals.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Topic 27, Metals. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.	1. Recommended a. Manufacturing: A Basic Text, Topic 27, Metals. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.

SELECTED INSTRUCTIONAL MATERIALS:

Film -- "Metalworking Series." Career Aids, Inc.

Film -- "Introduction To Metalworking Series." Bennett & McKnight.

ACTIVITIES 048

TEACHER	STUDENT
1. Have the students read pages 308-309, 313 and 315 on the cutting of metals.	1. Read pages 308-309, 313 and 315 on the cutting of metals.
2. Have the students read Topic 18, pages 369-374, on the casting of metals.	2. Read Topic 18, pages 369-374, on the casting of metals.
3. Have the students read Topic 19, pages 375-379, on the forging of metals.	3. Read Topic 19, pages 375-379, on forging of metals.
4. Have the students read Topic 19, pages 375-379, on bending of metals.	4. Read Topic 19, pages 375-379, on bending of metals.
5. Have the students read pages 318 and 321, on boring metals.	5. Read pages 318 and 321, on boring metals.
6. Have the students read Topic 8, pages 330-333, on metal turning.	6. Read Topic 8, pages 330-333, on metal turning.
7. Review and demonstrate each method with the class.	7. Identify in writing the ways of forming metals.
8. Have the students identify in writing the ways of forming metals.	

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value.

DESIGN IN METAL

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 049. Identify the different ways of fastening metal parts.

EQUIPMENT AND SUPPLIES: Examples of fastening.

STANDARD OF PERFORMANCE: Correctly identify in writing four of six methods used in fastening metal parts together.

ENABLING OBJECTIVE Differentiate among different metals and methods of forming.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Topic 9, Threaded Fasteners, Topic 12, Sodering, Topic 13, Oxyacetylene Brazing and Welding, Topic 14, Electric Welding. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.	1. Recommended a. Manufacturing: A Basic Text, Topic 9, Threaded Fasteners, Topic 12, Sodering, Topic 13, Oxyacetylene Brazing and Welding, Topic 14, Electric Welding. 2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.

ACTIVITIES 049

TEACHER	STUDENT
1. Have the students read and study Topic 9, Threaded Fasteners, Topic 12, Sodering, Topic 13, and Topic 14, Electric Welding, in recommended text.	1. Read and study Topic 9, Threaded Fasteners, Topic 12, Sodering, Topic 13, Oxyacetylene Brazing and Welding, in recommended text.
2. Review and demonstrate the different methods of fastening metal parts.	2. Define in writing the different ways of fastening metal parts.
3. Have the students define in writing the different methods of fastening metal parts.	

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 050. Identify the different ways of finishing metals.

EQUIPMENT AND SUPPLIES: Metal finish examples.

STANDARD OF PERFORMANCE: Properly identify in writing four of six methods used in metal finishing.

ENABLING OBJECTIVE Differentiate among different metals.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Manufacturing: A Basic Text.	a. Manufacturing: A Basic Text.
2. Suggested	2. Suggested
a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.	a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.

ACTIVITIES 050

TEACHER	STUDENT
1. Have the students read and study Topic 23, Finishing, pages 390-398.	1. Read and study Topic 23, Finishing, pages 390-398.
2. Review the different metal finishes with the class.	2. Identify in writing the different metal finishes.
3. Have the students identify in writing the different metal finishes.	

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value.

DESIGN IN METAL

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 051. Design a product using metal as the construction material and use the design process and idea-production techniques to help organize idea development.

EQUIPMENT AND SUPPLIES: Design Problem, Teacher handouts.

STANDARD OF PERFORMANCE: Work the design problem in metal with 70% accuracy according to the evaluation sheet in Appendix U, and the information given in Appendix O and Appendix P.

ENABLING OBJECTIVE Apply the design process, idea-production techniques, and basic information concerning metals.

REFERENCES

TEACHER	STUDENT
1. Recommended	1. Recommended
a. Appendix R, Example Problems I & II.	a. Appendix R, Example Problems I & II.
b. Appendix O, The Design Process.	b. Appendix O, The Design Process.
c. Appendix P, Idea-Production Techniques.	c. Appendix P, Idea-Production Techniques.
d. *Manufacturing: A Basic Text,* Chapter 7, "Designing and Engineering Products."	d. *Manufacturing: A Basic Text,* Chapter 7, "Designing and Engineering Products."

ACTIVITIES 051

TEACHER	STUDENT
1. Have the students review Appendices R, O, P and Chapter 7, "Designing and Engineering Products", in the recommended text.	1. Review Appendices R, O, P and Chapter 7, "Designing and Engineering Products", in the recommended text.
2. Review Appendices R, O, and P with the class, if needed.	2. Work the design problem in metal, using the design process and idea-production techniques in sketching possible, refined and final solutions to the problem.
3. Show examples of products in metal and discuss each in regard to design and construction.	
4. Review the design problem with the classmates and have them sketch possible, refined and final solutions to the problem in metal.	

EVALUATION CRITERIA: Use the creative abilities, fluency, flexibility, originality and elaboration to evaluate the design sketches. Assign a point value for each.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 052. Draw the final design solution in orthographic and add dimensions.

EQUIPMENT AND SUPPLIES: Drafting equipment, drafting pencils H, 4H and 11 X 17 paper.

STANDARD OF PERFORMANCE: Draw and dimension the final design presentation with 70% accuracy according to the evaluation sheet in Appendix U.

ENABLING OBJECTIVE Apply the principles of orthographic projection, correct dimensioning standards and drafting practices.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." b. Manufacturing: A Basic Text, Topic 1.	1. Recommended a. Mechanical Drawing, Chapter 5, "Multiview Drawing", and Chapter 6, "Dimensioning." b. Manufacturing: A Basic Text, Topic 1.

ACTIVITIES 052

TEACHER	STUDENT
1. Have the students review drafting and dimensioning practices, in the recommended text.	1. Review correct drafting and dimensioning practices, in the recommended text.
2. Review drafting and dimensioning practices with the class.	2. Draw the final design in orthographic and add dimensions. Position the drawing on one half of the 11 X 17 paper.
3. Have the students develop an orthographic drawing of their final design and then have them add dimensions. Position the drawing on one half of the 11 X 17 paper.	

EVALUATION CRITERIA: Instructor's evaluation of correct drafting and dimensioning practices. Assign a point value for each.

PERFORMANCE OBJECTIVE (2 - 3 Days)

TASK/COMPETENCY: 053. Draw the final design solution in oblique cabinet and render in ink stipple and line shading.

EQUIPMENT AND SUPPLIES: 11 X 17 paper, drafting equipment, technical ink pen ink and teacher handout.

STANDARD OF PERFORMANCE: Draw and render the final design presentation with 70% accuracy according to the evaluation sheet in Appendix U and Appendix K.

ENABLING OBJECTIVE Reproduce oblique drawing fundamentals and ink-rendering fundamentals.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing." b. Appendix K, Ink-Rendering Techniques.	1. Recommended a. Mechanical Drawing, Chapter 12, "Pictorial Drawing." b. Appendix K, Ink-Rendering Techniques.

ACTIVITIES 053

TEACHER	STUDENT
1. Have the students review Chapter 12, "Oblique Drawing", pages 278-283,in recommended text.	1. Review Chapter 12, "Oblique Drawing", pages 278-283 in recommended text.
2. Have the students review Appendix K, Ink-Rendering Techniques.	2. Review Appendix K, Ink-Rendering Techniques.
3. Have the students review the topic, Rendering, on pages 293-296, in recommended text.	3. Review the topic, Rendering on pages 293-296, in the recommended text.
4. Review oblique drawing and ink-rendering techniques with the class.	4. Draw the final design solution in oblique cabinet on the other half of the 11 X 17 paper.
5. Have the students draw their final solution in oblique cabinet on the other half of the 11 X 17 paper.	5. Render the oblique pictorial in ink stipple and line shading.
6. Have the students render the oblique in ink stipple and line shading.	

EVALUATION CRITERIA: Instructor's evaluation in regard to correct ink drafting and ink-rendering practices. Assign a point value.

DESIGN IN METAL

PERFORMANCE OBJECTIVE (1 - 2 Days)

TASK/COMPETENCY: 054. Develop a parts-material list and a plan of construction for the product design in metal.

EQUIPMENT AND SUPPLIES: Teacher handout, blank forms.

STANDARD OF PERFORMANCE: Complete a parts-material list and a plan of construction for the design problem in metal. All parts and materials needed for the construction of the project should be included. All construction procedures should be correctly indicated.

ENABLING OBJECTIVE Apply basic metal working tools and equipment, and basic metal working information.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, pages 60-68, Understanding Production Plans and Unit IV, Production Plans.	1. Recommended a. Manufacturing: A Basic Text, pages 60-68, Understanding Production Plans and Unit IV, Production Plans.
2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.	2. Suggested a. Modern Metalworking, John Walker. Goodheart-Wilcox Company, Inc.

ACTIVITIES 054

TEACHER	STUDENT
1. Have the students read and study pages 60-68, Understanding Production Plans, in recommended text.	1. Read and study pages 60-68, Understanding Production Plans.
2. Have the students read and study Unit IV, Production Plans, in the recommended text.	2. Read and study Unit IV in the recommended text.
3. Review with the class the parts list and plan for construction in the recommended text.	3. Develop a parts-material list and plan of construction for the final design in metal. Use the examples in the recommended text as a guide.
4. Have the students develop a parts list and construction plan for their final design in metal.	

EVALUATION CRITERIA: Instructor's evaluation in regard to accuracy and correct procedure. Assign a point value.

INDIVIDUAL PROJECT CONSTRUCTION

INTRODUCTION: After the designer has developed ideas, drawn and rendered a design concept, the development of a model, mock-up or prototype would be the next phase of the design process. This model, mock-up or prototype would be tested and analyzed to see if that design meets the design requirements in a three-dimensional form.

PERFORMANCE OBJECTIVE (1 Day)

TASK/COMPETENCY: 055. Define the following terms as they relate to product design: model, mock-up and prototype.

EQUIPMENT AND SUPPLIES: Examples of model, mock-up, prototype.

STANDARD OF PERFORMANCE: Correctly identify in writing, a model, mock-up and prototype as stated in the recommended text.

ENABLING OBJECTIVE Identify a model, mock-up and prototype.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text.	1. Recommended a. Manufacturing: A Basic Text.

ACTIVITIES 055

TEACHER	STUDENT
1. Have the students read page 126, concerning models, in the recommended text. 2. Have the students read pages 89-99, concerning mock-ups and prototypes, in the recommended text. 3. Review and show examples of models, mock-ups and prototypes. 4. Have the students define in writing a model, mock-up and prototype.	1. Read page 126, concerning models, in the recommended text. 2. Read pages 89-99, concerning mock-ups and prototypes, in the recommended text. 3. Define in writing a model, mock-up and prototype.

EVALUATION CRITERIA: Instructor's evaluation in regard to content and accuracy. Assign a point value.

INDIVIDUAL PROJECT CONSTRUCTION

PERFORMANCE OBJECTIVE (1 - 10 Days)

TASK/COMPETENCY: 056. Construct a protoytpe of one of the designs that have been developed.

EQUIPMENT AND SUPPLIES: Laboratory equipment and supplies, and various materials such as: wood, metal and plastic.

STANDARD OF PERFORMANCE: Construct a prototype of one of the designs that have been developed with 70% accuracy according to the evaluation criteria.

ENABLING OBJECTIVE Apply basic tools and equipment information and information concerning materials and construction and correct safety procedures.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text.	1. Recommended a. Manufacturing: A Basic Text.

ACTIVITIES 056

TEACHER	STUDENT
1. Have the students read page 99, Making A Prototype.	1. Read page 99, Making A Prototype, in the recommended text.
2. Review the safety rules and regulations with the class.	2. Review safety rules and regulations.
3. Have the students choose one of their designs they wish to construct.	3. Choose one design to construct.
4. Have the students review the design plans for possible modifications if needed.	4. Review the original plan and make changes if needed.
5. Have the students review parts-material list and plan for construction. Make modifications if needed.	5. Review parts-material list and plan for construction. Make modifications if needed.
6. Review proper tool and equipment usage and construction procedures.	6. Review proper tool and equipment usage and construction procedures.
7. Distribute materials needed for each project.	7. Obtain materials for the prototype.
8. Have the students begin work on the prototype.	8. Begin work on the prototype and perform the operations necessary for its construction.

EVALUATION CRITERIA: Instructor's evaluation in relation to:

1. Correct safety rules observed.
2. Wise use of materials.
3. Well-crafted product.
4. Well-followed plan.
5. Finish.
6. Time limit requirements.

Assign a point value to each.

GROUP MASS PRODUCTION PROJECT

INTRODUCTION: In today's modern society, consumer products must be produced by mass-production. It is important that the student understands the basic concept of mass-production and participates in the creation of a unique consumer product.

PERFORMANCE OBJECTIVE (1 - 10 Days)

TASK/COMPETENCY: 057. Participate in the planning and construction of a class mass-production project.

EQUIPMENT AND SUPPLIES: Laboratory equipment and supplies and various construction materials.

STANDARD OF PERFORMANCE: Participate as a part of the group to produce a class mass-production project. The evaluation criteria will be used to rate the student's performance and involvement.

ENABLING OBJECTIVE Apply basic tools and equipment information, basic information concerning materials and correct safety procedures.

REFERENCES

TEACHER	STUDENT
1. Recommended a. Manufacturing: A Basic Text, Chapter 9, "Planning and Production", Chapter 10, "Getting Ready to Manufacture", Chapter 11, "Producing the Products."	1. Recommended a. Manufacturing: A Basic Text, Chapter 9, "Planning and Production", Chapter 10, "Getting Ready to Manufacture", Chapter 11, "Producing the Products."

ACTIVITIES 057

TEACHER	STUDENT
1. Have the students read and study Chapter 9, "Planning a Production System", Chapter 10, "Getting Ready to Manufacture", and Chapter 11, "Producing the Products."	1. Read and study Chapter 9, "Planning a Production System", Chapter 10, "Getting Ready to Manufacture", and Chapter 11, "Producing the Products."
2. Have the students choose a product design from all the class designs.	2. Participate in the choosing of a product design to be mass-produced. Choose from all the class designs.
3. Review the safety rules.	3. Participate in the establishment of the materials needed for production.
4. Assign a job for each of the students.	4. Participate in the development of the sequence of operations.
5. Have the students review and establish material requirements.	5. Participate in the design of the jigs and fixtures needed for the mass-production of the product.
6. Have the students review and develop a sequence of operations.	6. Perform the necessary tasks to produce the product.
7. Have the students design the jigs and fixtures for the mass-produced product.	
8. Have the students mass-produce a product with each performing a certain task.	

EVALUATION CRITERIA:
1. Works well with other students.
2. Applies proper safety rules.
3. Performs task correctly.
4. Follows directions.

APPENDIX

APPENDIX A

Definition of Terms

Anthropometrics. The measurements of the average human body.

Cognitive-Creative Abilities. Mental abilities that creative people apply during the design process.

Consumer Product. A device to help people live more productive and meaningful lives. It can be any item designed to benefit mankind and marketed to the general public.

Copyright. Protection granted by a government to a designer to assure that their written or graphic designs will not be copied.

Creativity. The art of developing new ideas or combining previously-known ideas in such a way that is unique to the creator.

Design. Creative planning to meet a particular need.

Design Principles. Any new design must meet established principles, such as: unity, balance, proportion, harmony, and rhythm.

Design Requirements. Requirements that any new product must satisfy, such as: function, material and visual.

Dimensioning. A method of showing the sizes of a particular part or parts.

Fixture. A device used to hold a work piece during machining.

Forming. Changing the shape of a material without taking away any material.

Idea-Production Techniques. Ways of developing uncommon ideas for the solution of a particular problem.

Illustration. A pictorial drawing developed and rendered to simplify and interpret technical information.

Imagination. A mental process which allows a person to formulate mental images or concepts.

Isometric Drawing. A kind of pictorial drawing based on height, width and depth axes in equal 120° angles with each other.

Jig. A special device used to guide a cutting tool. It may also hold the workpiece.

Limitations. Factors that limit or restrict what can be done.

Logo. Any word or group of words or symbol that is used to identify a particular individual, company, institution or organization.

Mass Production. The manufacturing of a large quantity of identical parts or products in a short period of time.

Mock-up. Detailed mold of a product. It can be full size but does not have to be constructed of the final materials.

Model. A scaled-down version of the actual design.

Oblique Drawing. A kind of pictorial drawing that shows one face of the object in true shape, but other faces on a distorted angle.

Orthographic Projection. A system of drawing which shows an object in several views.

Parts List. A list of all the parts needed to produce a particular product.

Patent. Protection granted by a government to an inventor to assure the inventor that his design will not be copied.

Perspective Drawing. A kind of pictorial drawing that shows objects as they look to the eye.

Pictorial Drawing. A drawing that looks like a picture.

Plan of Procedures. A plan for the different operations that it would take to produce a particular product.

Possible Solutions. A quick note or sketch of a fleeting idea.

Problem Definition. Recognize the problem and break the problem down into parts. Design for each part, keeping the whole problem in mind.

Problem Solving. A process by which individuals use their creative imagination and knowledge in a structured and organized manner to solve a particular problem.

Product Design. Designing consumer products to meet the needs of the people.

Prototype. Full-size model of a product. It is a working model, using actual materials for its development.

Refined Solution. A more detailed examination and refinement of a good possible idea.

Rendering. Surface shading used to make the drawing look more realistic.

Sketching. A method of drawing using the free hand to draw an object.

Trademark. Any word or group of words or symbol that a maker or seller puts on a product to distinguish it from products made or sold by others.

APPENDIX B

Course Outline

I. Manufactured Product Design & Planning

II. Description:

Exploring the various elements of product design as they relate to areas such as: graphics, wood, metal, and plastic; with emphasis placed on experimentation and problem-solving in developing design solutions; development of detailed drawings, illustrations, and presentation of design ideas.

III. Textbooks:

Manufacturing A Basic Text By Fales, Sheets, Mervich and Dinan.

Mechanical Drawing By French, Svensen, Helsel and Urbanick.

IV. Course Objectives:

During and upon successful completion of this course the student should:

1. Develop or strengthen skills in designing functional products.
2. Develop or strengthen skills in planning the manufacture of a product.
3. Exercise their creative imagination and design potential in a structured way.
4. Develop or strengthen skills in illustration and presentation techniques.
5. Strengthen and develop sensitivity, awareness and appreciation of creative design.
6. Develop an understanding of materials and basic construction techniques.
7. Become aware of mass-production procedures.
8. Develop a self-confidence in his/her ability to be deliberately creative.
9. Develop basic skills in drawing and sketching.
10. Develop skills in problem solving.

V. Content:

A. Introduction To Design

1. What is design?
2. What is creativity?
3. What is problem solving?
4. What is imagination?
5. What is the importance of design?
6. What is the importance of creativity?
7. How can you develop your creative ability?
8. What is product design?

B. Orientation To Product Design

1. Slide presentation
2. Lecture
3. Films

C. Orthographic Drawing, Sketching and Dimensioning

1. Drafting equipment and supplies
2. Lettering
3. Measurements and scale
4. Alphabet of lines
5. Sketching techniques
6. Dimensioning
7. Drawing techniques
8. Assigned drawing and sketching problems

D. Pictorial Drawing, Sketching and Rendering

1. Isometric sketching and drawing
    a. Lecture
    b. Assigned problems
2. Oblique sketching and drawing
3. Angular perspective sketching and drawing
    a. Lecture
    b. Assigned problems
4. Rendering techniques
    a. Pencil (graphite and color)
    b. Ink
    c. Assigned exercises and drawings
5. Presentation drawings and illustrations

E. Design Requirements

1. Material
2. Function
3. Visual
4. Human factors (anthropometric data)

F. Design Principles

1. Unity
2. Balance
3. Proportion
4. Harmony
5. Rhythm

G. Problem-Solving Processes

1. Design analysis (Lindbeck)
    a. Problem definition
    b. Analysis of the problem
    c. Possible solutions
    d. Analysis of possible solutions
    e. Refined solutions
    f. Analysis and testing
    g. Final solution

H. Idea-Producing Techniques and Cognitive-Creative Abilities

1. Idea techniques
    a. Association
    b. Partial
    c. Redesign
    d. Basic shapes
    e. Scribble
    f. Forced relationships
    g. Bionics (study of nature)
    h. Check listing
    i. Brainstorming
2. Creative abilities
    a. Fluency
    b. Flexibility
    c. Originality
    d. Elaboration

I. Example Problems
1. I Product design
2. II Graphic design

J. Graphic Design, Package Design

1. Lecture (graphic design)
2. Production techniques (printing)
    a. Camera-ready copy
    b. Offset
    c. Silk screen
    d. Layout and design
    e. Safety
    f. Type styles
3. Copyrights
4. Graphic design problem

    a. Introduction to the problem (define the problem)
    b. Analysis of the problem (research limitations)
    c. Sketches of possible design ideas (use idea-production technique)
    d. Analysis
    e. Refine ideas
    f. Analysis and testing
    g. Final solution
5. Draw and render final design in ink and color pencil

K. Design In Wood

1. Commercial and/or residential application
2. Technical information and construction procedures
    a. Different woods and their characteristics
    b. Joints
    c. Adhesives
    d. Safety rules and regulations
    e. Forming and shaping wood
        1. Cutting
        2. Drilling
        3. Sculpturing
        4. Sanding
        5. Turning
    f. Finishes
3. Patents
4. Design Problem (where wood is the major material used)
    a. Introduction to the problem (define the problem)
    b. Analysis of the problem (research limitations)
    c. Sketches of possible design ideas (use idea-production techniques)
    d. Analysis
    e. Refine ideas
    f. Analysis and testing
    g. Final solution
    h. Draw final solution, (orthographic and pictorial)
    i. Dimension orthographic view
    j. Render the pictorial in pencil
    k. Plan for construction (how it would be produced)
    i. Specification of materials (parts list and materials)

L. Design in Plastic

1. Commercial and/or residential application
2. Technical information and construction procedures
    a. Types of plastic
    b. Methods of forming
        1. Injection
        2. Extrusion
        3. Casting
        4. Vacuum
        5. Sheet Acrylic
        6. Cutting

   7. Bending
   8. Adhesives
   9. Joints
   10. Finishing
   11. Safety
3. Design Problem (where plastic is the material used)
   a. Introduction to the problem (define the problem)
   b. Analysis of the problem (research limitations)
   c. Sketches of possible design ideas (use idea-production techniques)
   d. Analysis
   e. Refine ideas
   f. Analysis and testing
   g. Final solution
   h. Presentation drawing and illustration (orthographic and pictorial) (pencil rendering)
   i. Plan for construction
   j. Parts - material list

M. Design in Metal

   1. Commercial and/or residential application
   2. Technical information and construction procedures
      a. Kinds
      b. Shapes
      c. Bending
      d. Boring
      e. Cutting
      f. Casting
      g. Welding and fastening
      h. Forging
      i. Finishes
      j. Turning
      k. Safety
   3. Design Problem (where metal is the major material used)
      a. Introduction to the problem (define the problem)
      b. Analysis of the problem (research limitations)
      c. Sketches of possible ideas (use idea-production techniques)
      d. Analysis
      e. Refine ideas
      f. Final solution
      g. Presentation drawing and illustration
         1. Orthographic drawing w/dimensions (ink)
         2. Pictorial Drawings and illustration (ink-line shading and stipple)
      h. Plan for construction (how it would be produced)
      i. Parts - material list

N. Three-Dimensional Development of Design Solution

1. Model
2. Mock-up
3. Prototype

O. Individual Construction of One-Design Solution

1. Review the original plan (make modifications if needed)
2. Choose materials
3. Develop construction strategy
4. Construct a prototype

P. Group Mass-Production Project

1. Class will choose one design from all the designs
2. Develop jigs
3. Develop fixtures
4. Develop construction sequence and strategy
5. Each student will perform a task in producing a product

VI. Requirements:

1. Satisfactory completion of assigned design problems.

2. Satisfactory completion of working drawings and presentations.

3. Completion of one model or prototype (individual or class mass produced).

4. Satisfactory completion of examinations based on
    a. Class lectures
    b. Assigned readings
    c. Information supplied

VII. Overall Evaluation:

Total accumulation of points in relation to the number of points possible.

1. Drawings and illustrations

2. Design problems

3. Completed model or prototype

4. Class participation

5. Test scores (design, creativity, and problem solving information) (materials and construction)

6. Attendance

100 - 93 = A
92 - 85 = B
84 - 77 = C
76 - 69 = D
68 - 0 = F

VIII. Evaluation of Design Problems:

Each problem will be evaluated on

1. Fluency of ideas
2. Flexibility of ideas
3. Originality
4. Elaboration

A point value is attached to each of these and a final score is compiled.

APPENDIX C

Overall Tool and Equipment List

DRAFTING

- French curve
- Triangles 30 - 60 and 45
- Protractor
- Drawing pencils H, 2H, 4H, 6H
- Sketching pencils HB, 2B, 4B
- Circle template
- Ellipse template
- Compass
- Dividers
- Eraser
- T-square
- Architect's scale
- Technical ink pen #1 or #2
- Color pencils

GRAPHIC ARTS

- Off-set press
- Camera
- Darkroom equipment
- Plate maker
- Developing sinks
- Paper cutter
- Light table
- Film dryer

WOODS

- Clamps
- Glue table
- Band saw
- Wood lathe
- Surfacer
- Table saw
- Drill press
- Grinder
- Hand tools
- Jig saw
- Finish room
- Disc and belt sander
- Tool cabinets
- Jointer
- Radial arm saw
- Work benches

- Vises
- Drill bits
- Router and router bits
- Hand sander
- Blades (table saw, band saw)

PLASTIC

- Strip heater
- Heat gun
- Oven
- Plastic cutting blades
- Buffer

METAL

- Tubing or rod bender
- Metal sheer
- Metal lathe
- Drill bits
- Sand ben
- Foundry equipment
- Foundry furnace
- Box and pan break
- Anvil
- Metal working hand tools
- Welding equipment
- Welding booth
- Shaper

APPENDIX D

Overall Supply List

DRAFTING

- 1/4" Grid paper
- 8 1/2" X 11" and 11" X 17" Tracing paper
- Drafting tape
- Cold press bristol board
- Hot press bristol board
- Strathmore paper
- Technical drawing ink

GRAPHIC ARTS

- Photographic film
- Paper for offset press
- Film developing supplies
- Stripping supplies
- Golden rod
- Silk-screeeen
- Silk-screen frames
- Silk-screen supplies
- Silk-screen ink (various colors)
- Offset inks (various colors)
- Drymount letters (various styles and sizes)
- Paper for layout and design

WOODS

- Wood
- Adhesives
- Sand paper
- Finishing materials
- Dowel rods

PLASTIC

- 1/4" Acrylic sheets (Black, Clear, Mirror)
- 1/8" Acrylic sheets (Black, Clear, Mirror)
- Acrylic rods (1/4", 1/2", 3/4", 1")
- Plastic adhesive
- 0000 Steel wool
- Polishing compound
- Buffing wheels

METAL

- Casting material (metal)
- Sheet metal
- Casting sand
- Foundry supplies
- Finishing supplies
- Styrofoam (for patterns)
- Metal stock (various shapes)
- Welding supplies

APPENDIX E

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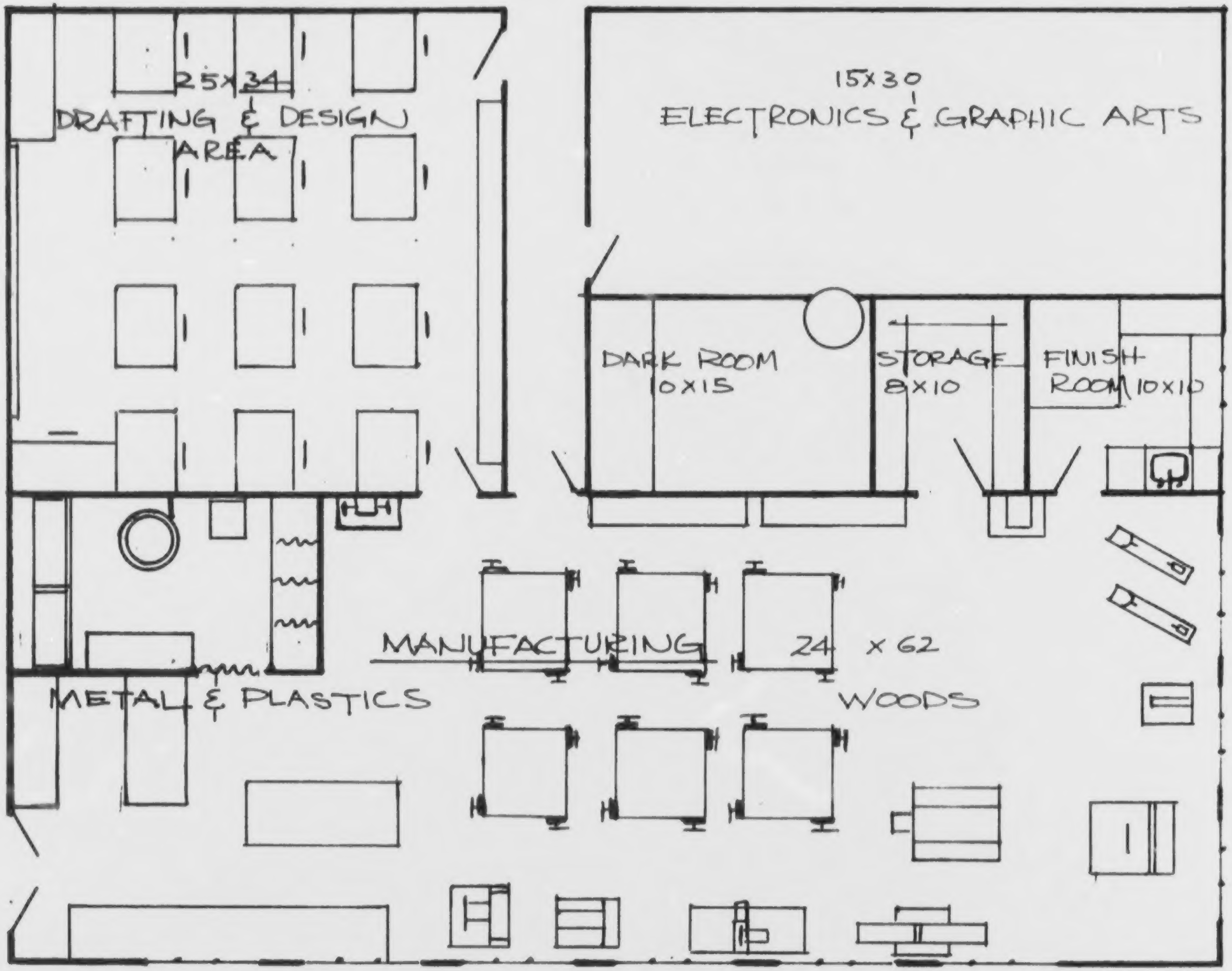
FOR EXAMPLE ONLY
(For detail specifications contact Industrial Education Unit)


25X34
DRAFTING & DESIGN AREA
15X30
ELECTRONICS & GRAPHIC ARTS
DARK ROOM 10X15
STORAGE 8X10
FINISH ROOM 10X10
MANUFACTURING
24 X 62
METAL & PLASTICS
WOODS

POSSIBLE FACILITY LAYOUT FOR MANUFACTURED PRODUCT DESIGN & PLANNING CLASSES. (MINIMUM CLASS ROOMS)
TOTAL= 3128 SQ.FT. MINIMUM SIZE FOR ONE TEACHER

APPENDIX G

Definition of Design Terms

1. DESIGN

The term design is a broad concept which means different things to different people. If you were to ask ten people to define design you would receive ten different responses. This would occur because design is a term that is attached to a variety of planned experiences. Planning for a house, a book, highway, consumer product or a spacecraft would fall within the broad definition of design. John Lendbeck has developed a clear and practical definition which is easily understood.

"Design is creative planning to meet a specific need."[1]

There are several key words in this definition, such as planning and need, which should be discussed. For a design to be successful there must first be a need for that design. Having established a need, the designer would then plan to meet that need. Throughout the planning the designer must keep in mind certain distinct elements that are associated with a completed design task. First of all, functional requirements of the design must be considered. Will the design solutions work? Will they perform the task or function that is dictated by the need? A chair, for example, must support the human body comfortably.

The second consideration would be the materials to be used in the design. The need again plays a part in determining what materials are more desirable. If the need calls for a chair to be used out of doors, then the materials should be of the type that are resistant to all types of weather and should be reasonably strong. In this case materials such as aluminum, stainless steel, plastic or a combination of these could be used.

Finally and possibly the most difficult are the visual requirements of a design. The designer must arrange certain elements such as lines, shapes, color and texture in a manner which he feels is visually attractive. It is a known fact that if a design is visually appealing and fulfills the functional requirements, that design is successful.

In the final analysis, good design is a combination of several elements which are integrated to produce an end product that has clean, smooth-flowing lines free from extraneous decoration. For maximum effect the form of the design should be simple and uncluttered with the physical organization of materials arranged to fulfill the functional requirements.

2. CREATIVITY

Creativity can be defined as the art of developing new ideas or combining previously-known ideas in such a way that is unique to the creator. If a design problem is solved by individuals in a manner which is original to them, it is a creative solution for that individual.

Like design, creativity is applied in different ways. Art, music, literature and technology education all have creativity involved but have different end products. Leading psychologists cannot agree on a single definition for creativity, but they do agree that creativity is composed of several factors or abilities which can be developed if given the opportunity.

Four creative abilities that are appropriate for technology education, as well as other areas, are: fluency, flexibility, originality and elaboration. Fluency is the rapid production of ideas in a situation containing relatively little restrictions. Flexibility is the ability to develop a wide variety of ideas during the solution of a particular problem; the ability to deviate from a single idea. Originality is the ability to produce uncommon or statistically infrequent responses. Elaboration is the ability and desire to expand or follow through with a design concept.[2]

Creativity has been ignored or misunderstood in a variety of ways. For example, some people believe that creativity is an inborn trait and cannot be taught. To the contrary, creativity is found in every educable person and only needs to be recognized and developed. It is a known fact that the more individuals uses their mental and physical abilities the stronger they become; so it is with creativity. The linkage of creativity and intelligence is another misconception that is of popular belief. Individuals with high IQ's are not always the more creative. There is a relationship but a highly intelligent person is not necessarily the most creative.[3]

3. IMAGINATION

Imagination is a mental process. It is a person's ability to formulate mental images or concepts.[4] Many people believe that imagination and creativity are the same thing. This is not true; an individual can be imaginative without being creative. For example, a person can day dream and not put those ideas into any practical application. Creativity and imagination go hand in hand; a person cannot be creative without being imaginative, but they can be imaginative without being creative. For people to take full advantage of their creative potential they must be given an opportunity to exercise their imagination in a structured and supervised manner, thus combining their creative and imaginative abilities for some practical application.[5]

4. PROBLEM SOLVING

Problem solving is a process by which an individual or group of individuals use their creative imagination and knowledge in a structured and organized manner to solve a particular problem.

Lendbeck, in his book, Designing Today's Manufactured Products, outlines a simple and practical way of systematically organizing ideas in the pursuit of solving design problems. Lendbeck suggests that a problem-solving process should be:

1. Statement of the Problem
2. Analysis and Research
3. Possible Solutions
4. Analysis and Experimentation
5. Refined Solutions
6. Analysis and Testing
7. Final Solution[6]

A more detailed description and discussion of each aspect of the problem-solving process will come later in this study.

PRODUCT DESIGN

Product design can be defined as: designing consumer products to meet the needs of the people. These products are used in everyday life. They must be functional, visually appealing, constructed of appropriate materials and capable of being mass produced economically.

APPENDIX H

The Importance of Creativity and Design

Why are creativity and design important?

For an individual to fully understand the basic concepts involved in design and creative thinking, that individual must realize that every convenience we have today can be contributed to someone's creativity, design ability and hard work. The creative designer is the person who generates the ideas and works closely with manufacturers to see their ideas become reality.

In our society, many people overlook the role the designer plays in the manufacturing process. They only see the product in its finished stage and don't realize the effort that went into the initial research and development of that product.

Without creative and imaginative people, our society would become stagnant and cease to grow and progress. The importance of the designer and creative thinker cannot be over-emphasized. They are designing for the benefit of mankind. Industry and our society in general needs creative problem-solvers and creative decision-makers, our very existence depends on them.

APPENDIX I

How do you develop creative ability?

To recognize and develop your creative ability is not a monumental undertaking. A person only needs to have a desire and follow a few basic facts. Research supports the reasoning that individuals can become more creative simply by taking the initiative and trying to cultivate their creative potential. Becoming sensitive to every day articles around us, critically analyzing and evaluating them in terms of function, materials and visual appeal is a beginning toward developing creative ability. The casual stopping in front of a downtown store window to appraise a particular product they may have on display and looking through magazines, can initiate the development of one's creative ability. It would also be advantageous to familiarize yourself with all types of literature containing examples of good design. Several excellent periodicals and books are available which can keep you abreast of what is happening in the design field. This type of literature can supply information concerning examples of well-designed products, new materials and construction techniques. Personal design experiences, where you as an individual actually design or redesign existing products, will also aid in developing your creative ability. This could be accomplished either mentally or through sketches which would serve as a record of your ideas.

Alex Osborn, in his book, Applied Imagination, states several ways in which creativity can be developed. His suggestions are:

1. Have a broad range of experiences.
2. Don't be a creature of habit.
3. Play games or mind-teasing puzzles.
4. Travel as much as possible.

5. Have hobbies.
6. Draw and paint.
7. Read a variety of materials.
8. Try creative writing.
9. Keep a diary of meaningful experiences.
10. Redesign existing consumer products.

Osborn further states that, above all, a person must have the desire to become more creative and then practice, practice, practice.[8]

APPENDIX J

Pencil-Rendering Techniques

Learning some basic pencil-rendering techniques is not a monumental undertaking. By following a few basic principles and rules anyone can learn to shade or render an object with some degree of success. Follow these rules and suggestions and the results may be surprising.

Pencil-Rendering Steps and Suggestions

Transfer

When you transfer your drawn object to good paper, remember to transfer with a hard drawing pencil and only show a light outline of the object to be rendered. Transfer can be accomplished with a light table, held up to a window, or use graphite on the back of the original drawing, which will now serve as a carbon.

Pencils

H, HB, 2B, 4B.

Sharpening

Pointed or flat end.

Paper

Cold press Bristol board or Strathmore art paper.

Light Source

Choose a light source that will show the object the best. Generally, a light source from the upper right or upper left will be sufficient.

Pencil Strokes and Tones

Pencil strokes and pressure are very important. Start out with an HB pencil and work from light to dark or dark to light, varying the pencil pressure to achieve a darker tone or lighter tone. Remember, don't rush, build the tones. Don't try to establish a dark tone with just a few strokes.

Some people like to use the point of the pencil, while others prefer the pencil at an angle and rendering with the side of the lead. Personally, I prefer doing both, starting out on the point and then the side of the lead to smooth and blend rough areas.

The strokes that are used to render an object can vary, but in most cases the shape of the object or the direction of the plane will dictate what stroke directions could be used.

In any pencil rendering there are at least three basic tones; light, medium, and dark. Usually the areas of an object away from the light are hidden from the light and would be darker, any area close or exposed to the light would be the lightest areas. Areas in between would be medium in tones. Flat areas can be one even tone whether they be dark, medium, or light. However, curved or rounded surfaces must show a graduation of tone from light to dark. Blending tones from light to dark, without showing any visible evidence of changing from one to another, seems to be one of the hardest techniques to learn and will take some practice.

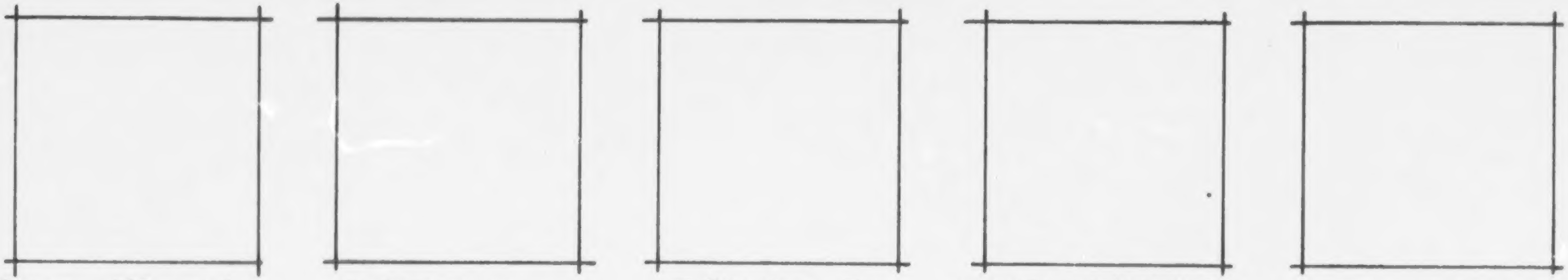
Remember, when rendering, always keep the light source in mind and render the object accordingly. There must be a good contrast between light and dark areas to achieve a professional look. In pencil rendering there is no substitute for patience; take your time and practice, practice, practice.

Neatness

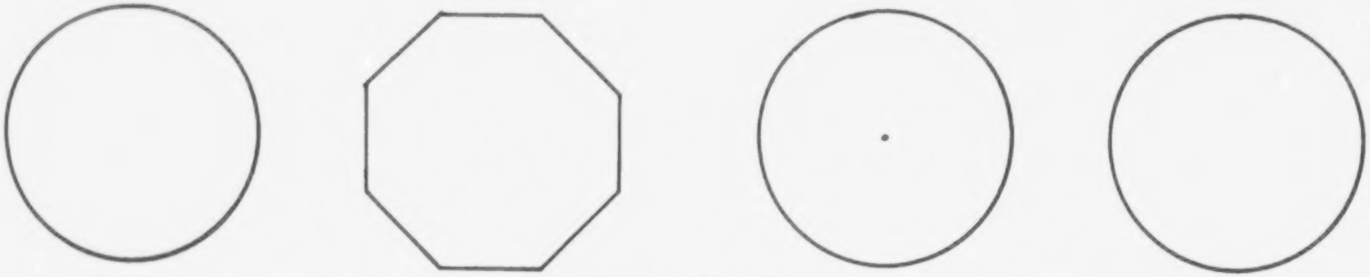
Always keep something under your hand. Graphite is very easy to smear and this can affect the overall quality of your rendering. When your rendering is complete, spray it with spray fixative.

Sharp Clean Edges

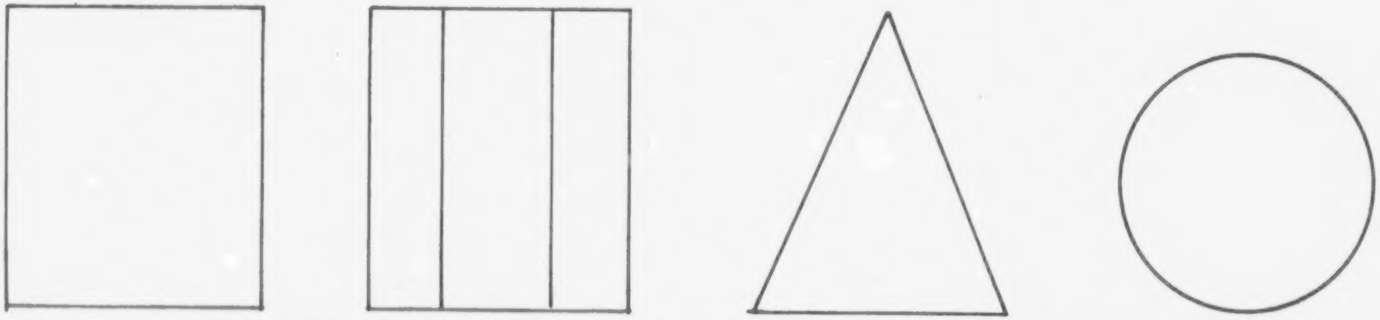
The final rendering must have clean sharp edges but, do not draw a bold outline around the object. Allow the shading to show the boundaries of division between planes.


CROSS-HATCH
STIPPLE
SMUDGE
LINE SHADING
BLEND

PRACTICE STROKES



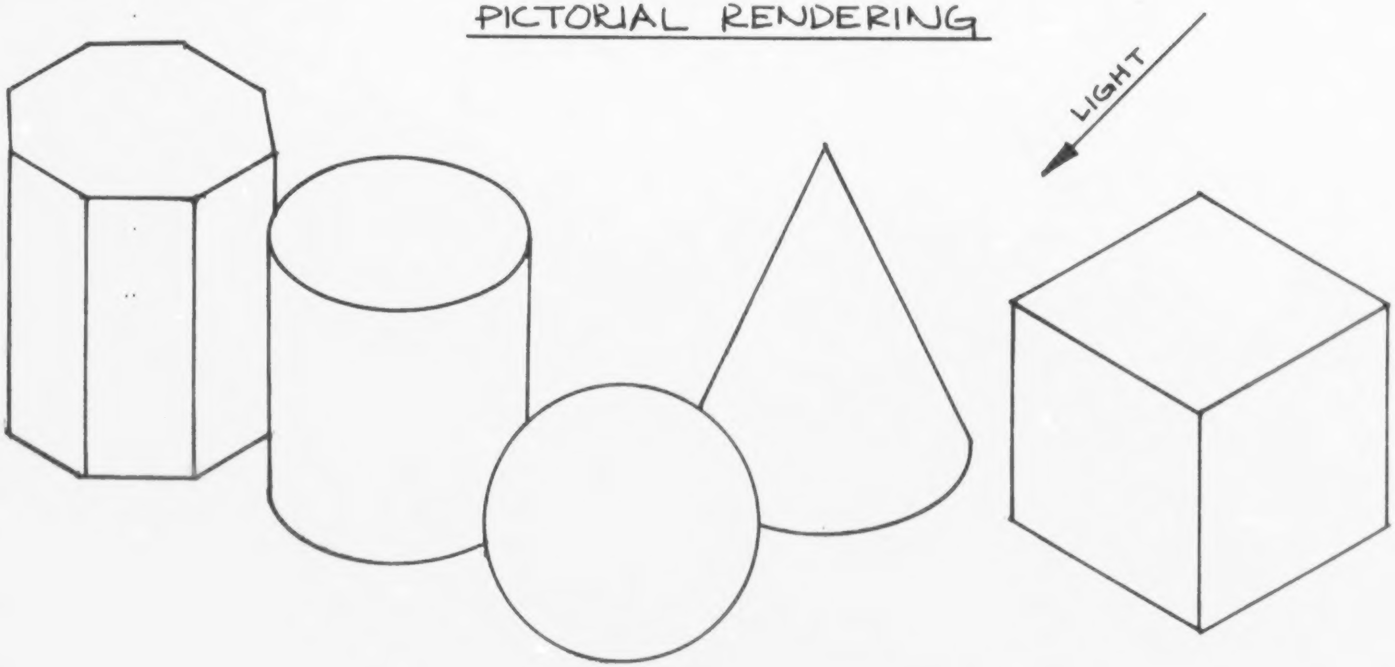
TOP VIEWS

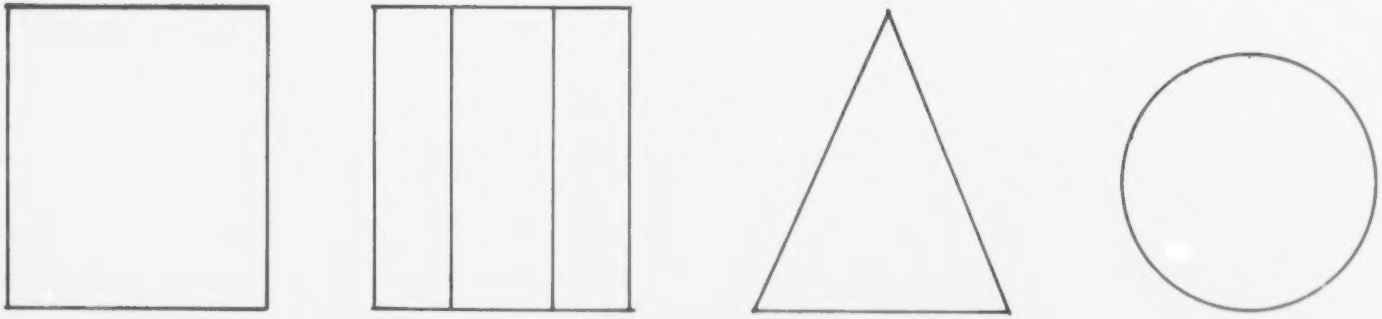


ORTHOGRAPHIC FRONT VIEW SHADING EXERCISE

NAME:	TITLE: PENCIL RENDERING	DATE:	DWG. 16

PICTORIAL RENDERING



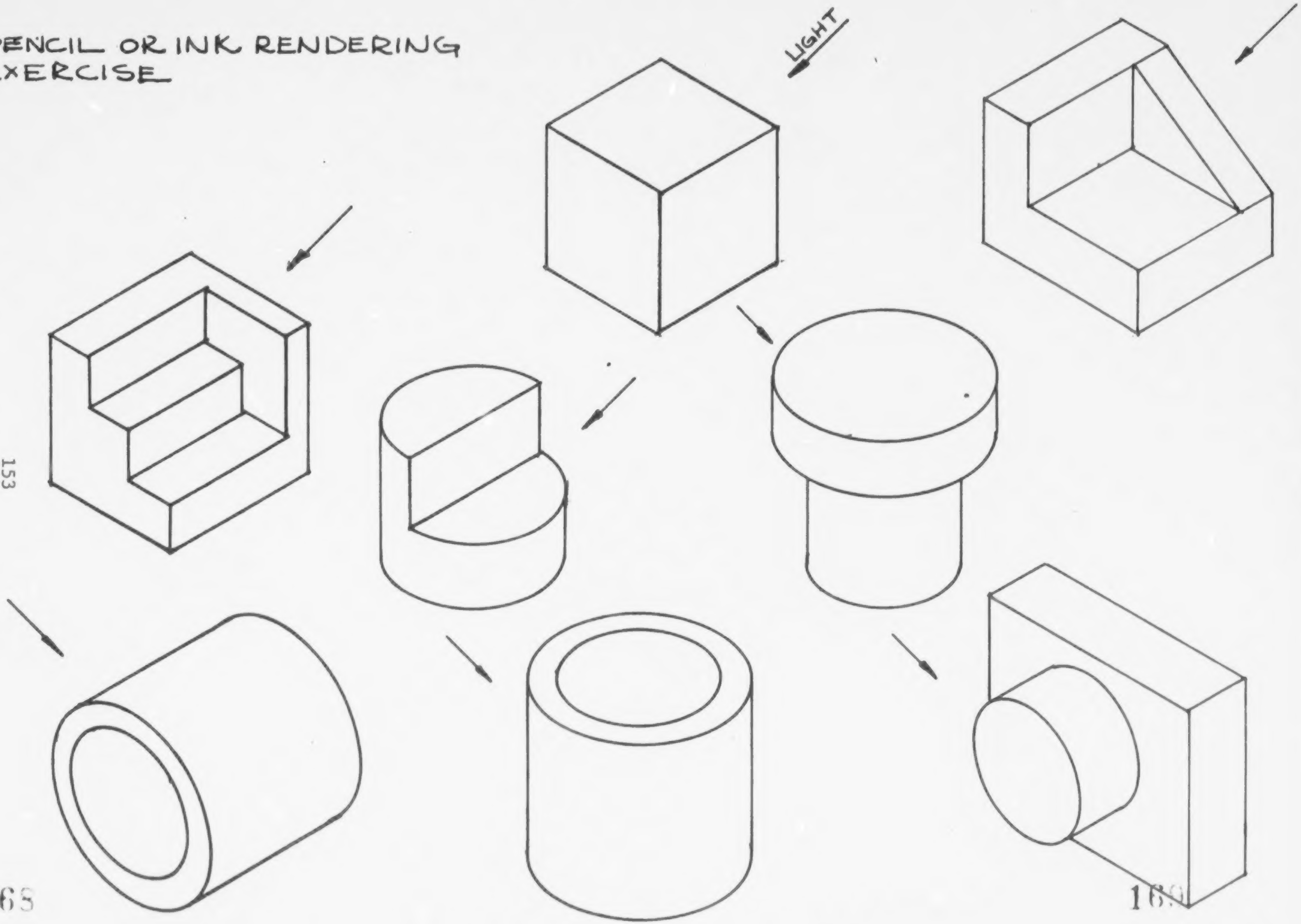


ORTHOGRAPHIC RENDERING

THIS DRAWING CAN BE RENDERED IN PENCIL OR INK.

NAME:	TITLE: ORTHOGRAPHIC AND PICTORIAL	DATE:	DWG:

PENCIL OR INK RENDERING
EXERCISE



153

168

169

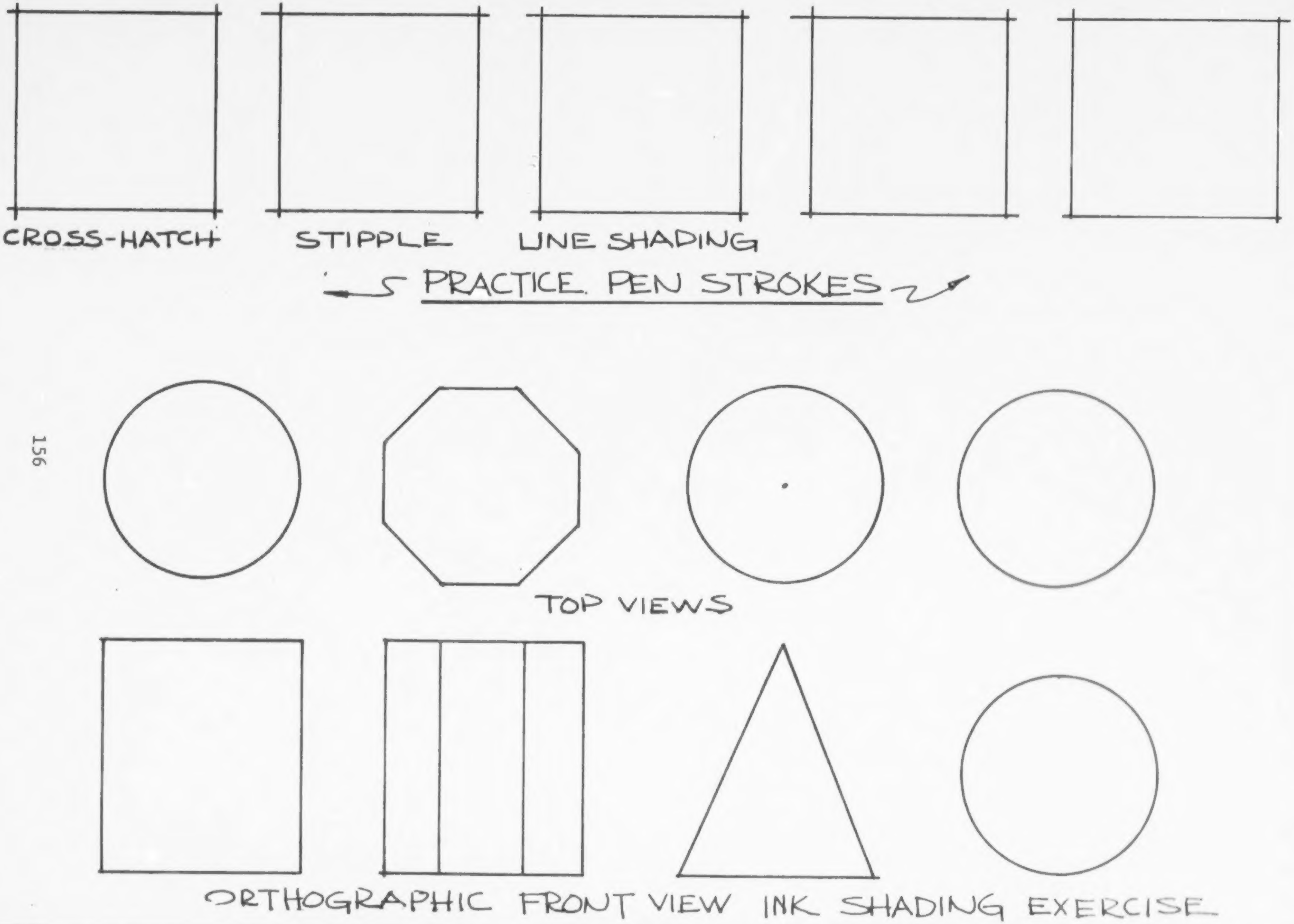
NAME:	TITLE: PICTORIAL RENDERING	DATE:	DWG:

APPENDIX K

Ink-Rendering Techniques

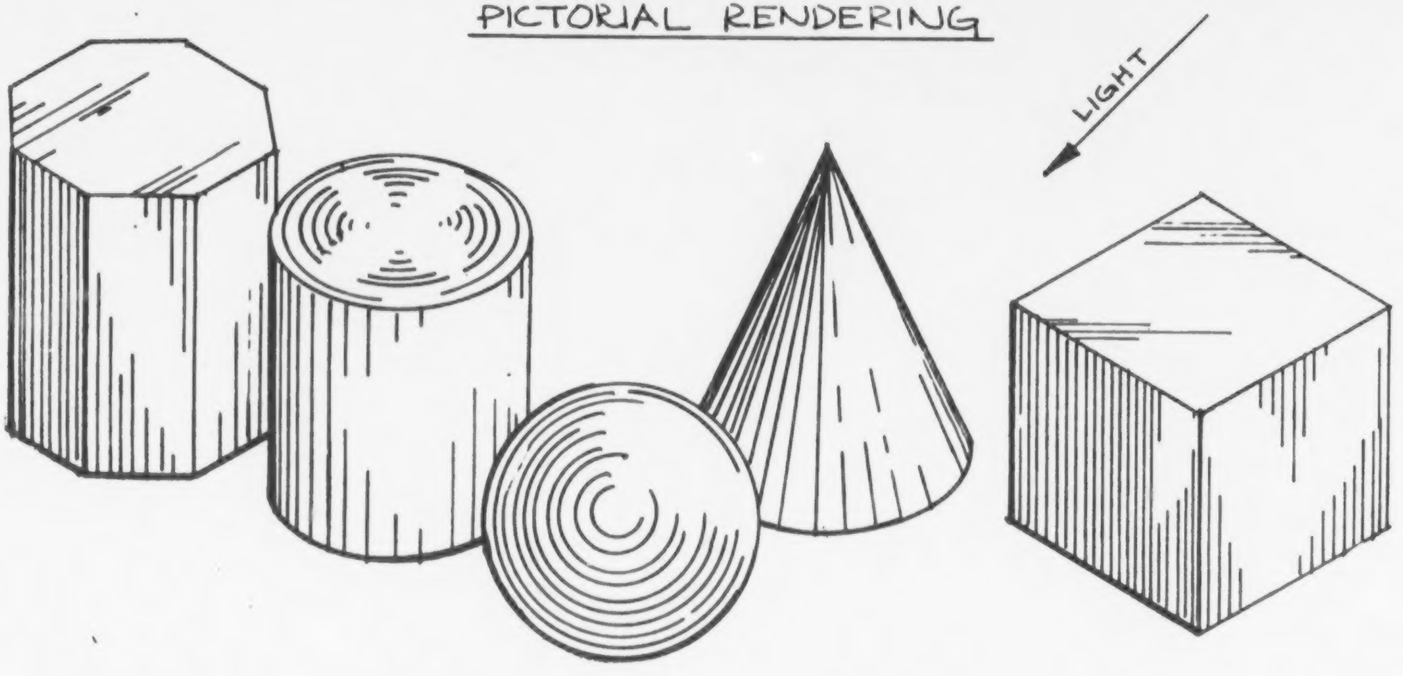
Instructions:

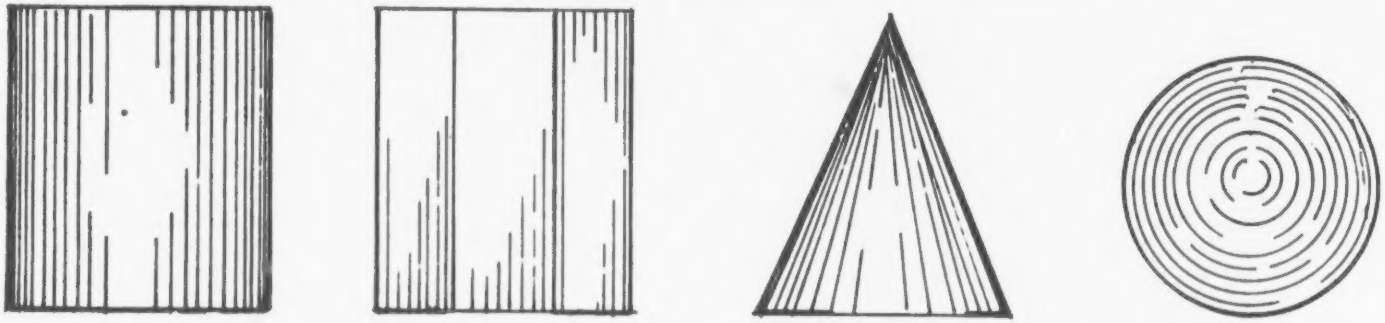
1. Use a 0 or 1 technical pen and drafting equipment.
2. Draw a light pencil outline of the object you wish to render on hot press Bristol board or on tracing paper.
3. Choose a light source.
4. Plan and draw light pencil lines where you wish the line shading to be. Remember, smooth surfaces will be line shaded and rough surfaces will be stippled.
5. Draw the line shading in ink, if the previously drawn pencil lines seem to be appropriate. Follow correct ink-drafting practices.
6. Stipple the rough areas; remember, the dark tones will have dense stipple and the lighter tones will have much less stipple.


CROSS-HATCH
STIPPLE
LINE SHADING
PRACTICE PEN STROKES
TOP VIEWS
ORTHOGRAPHIC FRONT VIEW INK SHADING EXERCISE

NAME: 171	TITLE: INK RENDERING	DATE: 172	DWG:

PICTORIAL RENDERING





ORTHOGRAPHIC RENDERING

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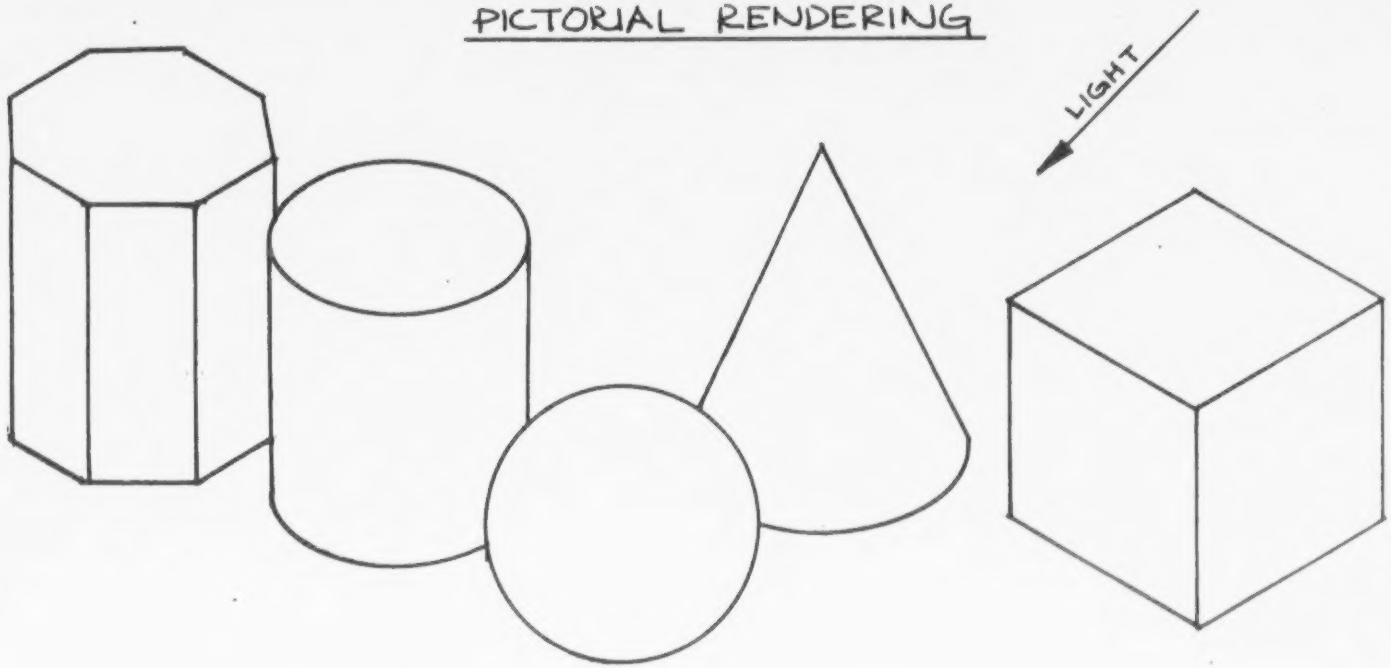
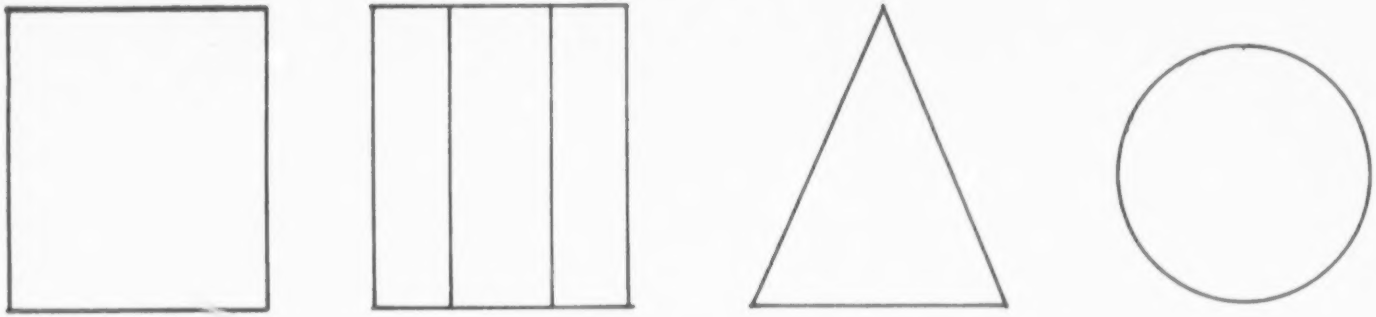
NAME:	TITLE: ORTHOGRAPHIC AND PICTORIAL	DATE:	DWG:

PICTORIAL RENDERING





ORTHOGRAPHIC RENDERING

THIS DRAWING CAN BE RENDERED IN PENCIL OR INK

NAME: 175	TITLE: ORTHOGRAPHIC AND PICTORIAL	DATE: 176	DWG:

APPENDIX L

Design Requirements

Function Requirements

For any design to be successful it must serve the purpose or function for which it is intended. In many cases a designer must do extensive research to establish what the actual function is and how to accomplish that function better than something that already exists. A well-designed item has style; it is made from appropriate materials and, above all, performs the function for which it was intended, easily, efficiently and economically.[9]

Material Requirements

There are a wide variety of materials available today that would lend themselves to product design construction. However, three types of materials make up the majority of consumer products today. These materials are: wood, metal and plastics. For a product design to be a success, the designer must choose the appropriate material or combination of materials. Selection of the correct material is vital in satisfying the material, functional, and visual requirements.[10]

Visual Requirements

This requirement is probably the hardest to satisfy for most beginning designers. There are no clear cut rules. There are so many different styles that it is hard for the beginner to establish a feel for aesthetically pleasing elements. Simply stated, the designer has a task of arranging lines, shapes, colors and textures in a way that is visually pleasing to the majority of the consumers.

The best way of establishing a feel for aesthetics in product design, is to study and saturate yourself with existing styles that are on the market today. Adopt the styles that are pleasing and interesting to you and use those styles to guide you in creating unique visual effects.[11]

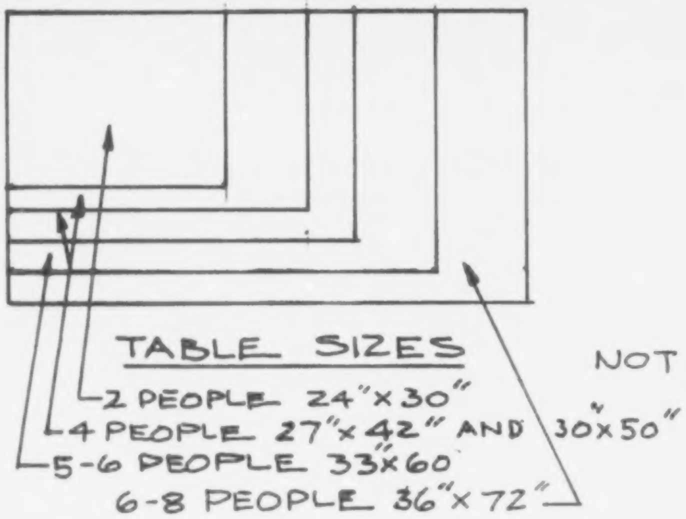
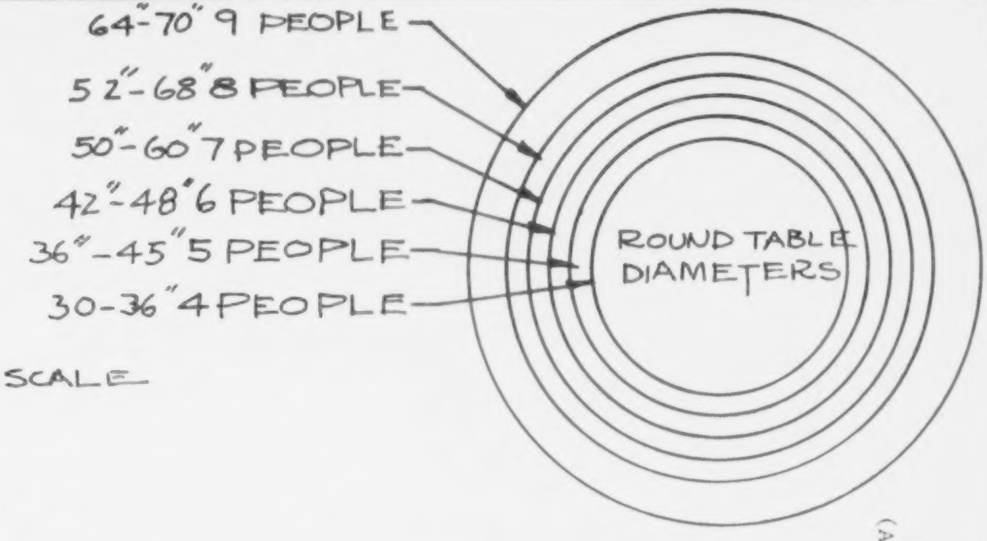
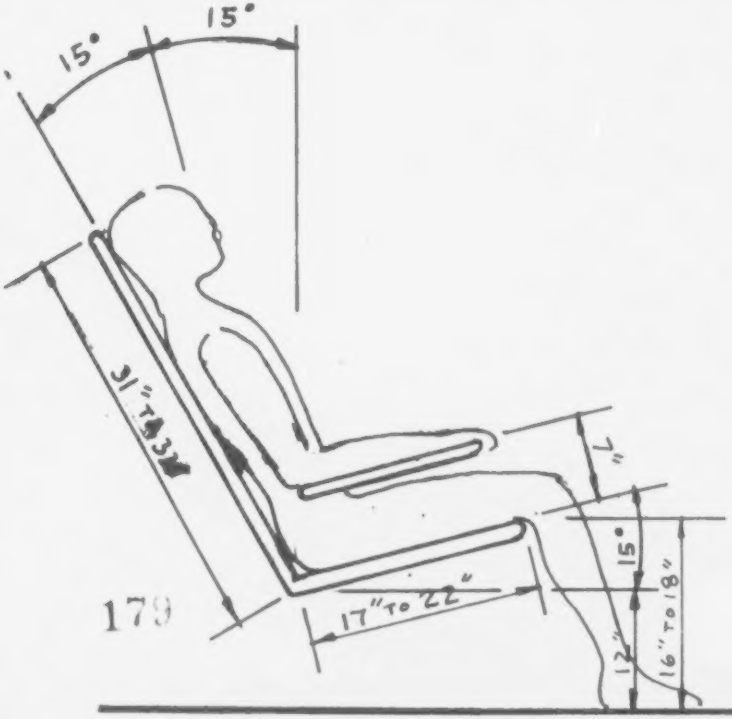


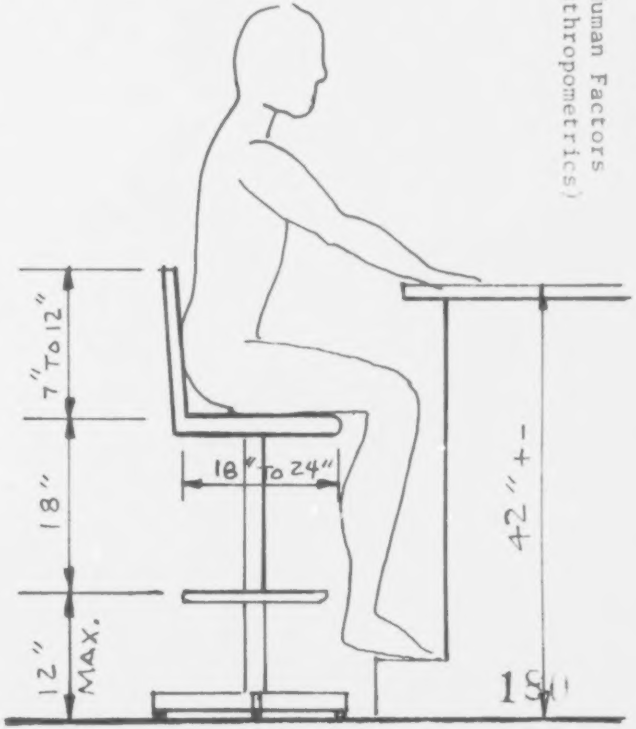
TABLE SIZES
2 PEOPLE 24" x 30"
4 PEOPLE 27" x 42" AND 30" x 50"
5-6 PEOPLE 33" x 60
6-8 PEOPLE 36" x 72"

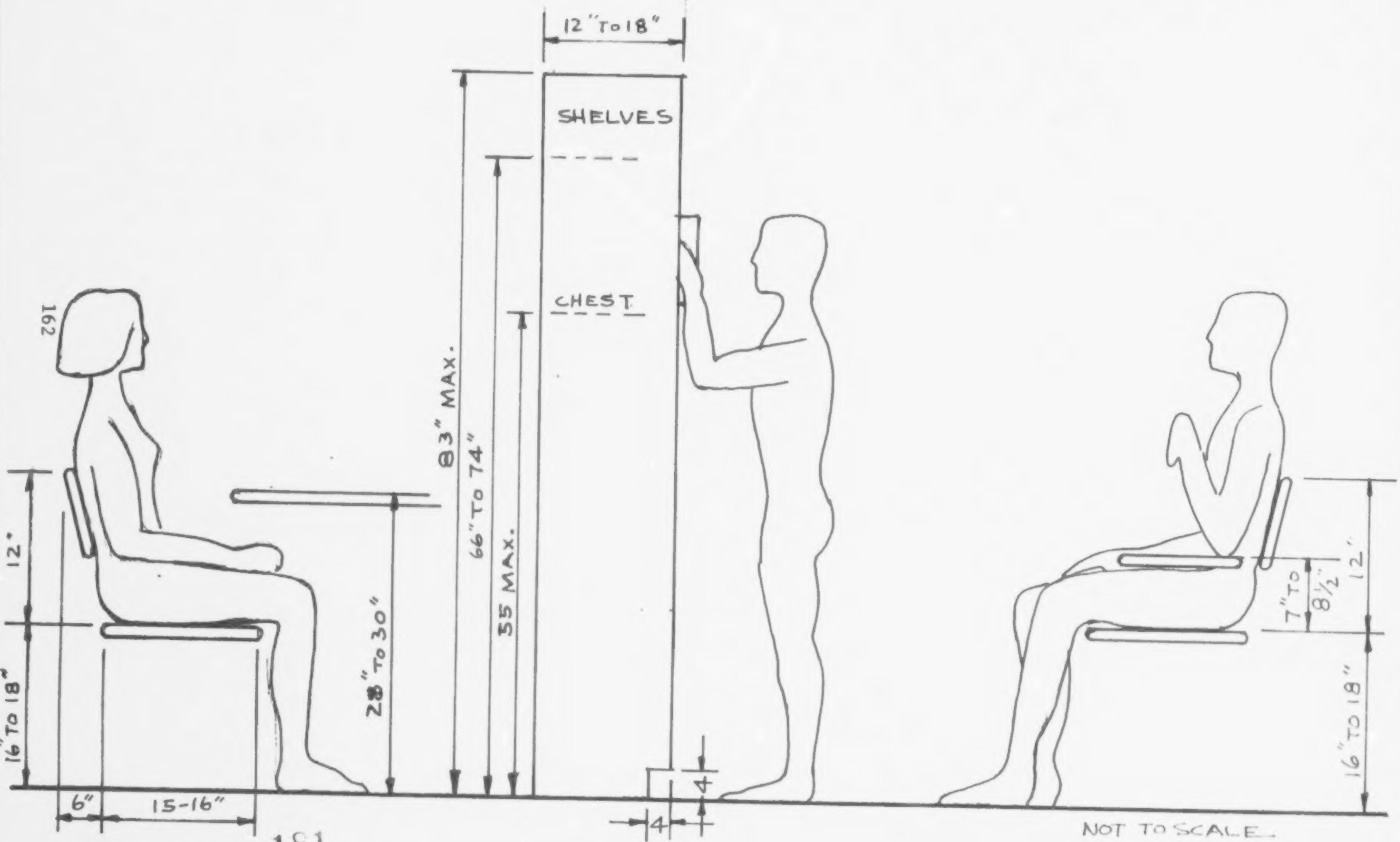
NOT TO SCALE


64"-70" 9 PEOPLE
52"-68" 8 PEOPLE
50"-60" 7 PEOPLE
42"-48" 6 PEOPLE
36"-45" 5 PEOPLE
30-36" 4 PEOPLE
ROUND TABLE DIAMETERS


15°
15°
31" TO 33"
7"
15°
17" TO 22"
12"
16" TO 18"

NOT TO SCALE


7" TO 12"
18"
12" MAX.
18" TO 24"
42" +-


12" TO 18"
SHELVES
CHEST
83" MAX.
66" TO 74"
55 MAX.
28" TO 30"
12"
16" TO 18"
6"
15-16"
4
4
7" TO 8½"
12"
16" TO 18"
NOT TO SCALE
162

181

182

- Lighting
    - Candles 1/4", 1/2", 3/4", 1", 2" diameter
    - Fluorescent bulbs 18", 24", 36", 48", 72", 96"
    - Incandescent 2 1/4" dia. x 4"
    - Table lamp varies in size, 18" approx. height.
        - (shade sizes vary, but in most cases the height of the shade should equal the lamp base height.)
    - Floor lamp 40" to 60"
    - Desk lamp 12" to 16"

- Beverages
    - Can 2 1/2" dia. x 5"
    - Wine Bottle 3 1/2" dia. x 14"
    - Wine glass 3 1/2" dia. x 4 1/2" to 6 1/2"
    - Water glass 2 1/2" dia. x 4 1/2" to 6 1/2"

- Eating Utensils
    - Spoons 1 1/4" x 7"
    - Forks 1" x 8", 1" x 7 1/2", 1" x 6 1/2"
    - Knife 3/4" x 7"
    - Plates 7 1/2" to 12"
    - Cups 3" x 3 1/2" dia.

- Records and Tapes
    - Records 7 1/2" x 7 1/2", 10 1/2" x 12", 12" x 14"
    - Tapes audio 2 1/2" x 4"
    - Tapes video 4" x 7 1/2"

- Books 5 1/2" x 8" to 8 1/2" x 11"

- Magazines 8 1/2" x 11" to 10" x 12"

- Tables
    - Coffee - various sizes 12" to 17" high
    - End - various sizes 17" to 28" high
    - Dining - various sizes 28" to 30" high

- Bar Stools
    - Seat size 18" x 24"
    - Various heights to seat 30" to 36"
    - Back 6" to 10" high

- Beds
    - Mattress sizes
        - Twin 39" x 75", 80" and 84"
        - Double 54" x 75"
        - Queen 60" x 80" and 84"
        - King 76" x 80" and 84"
        - Water sizes vary
    - Inner springs 5 1/2" to 6 1/2"
    - Foam 4" to 7 1/2"
    - Box spring 5 1/2" to 9"

Architectural Graphic Standards
Ramsey/Sleeper:
John Wiley and Sons

Appendix N

Design Principles

Unity

In product design the term unity can be defined as a "sense of belonging or similarity among the component parts in order to achieve wholeness." "If a design has unity, it means that everything in it is woven together according to some well-developed scheme or plan."[12]

Balance and Proportion

These terms are closely related and similar in many respects. However, balance is defined as the "quality of equilibrium achieved and sustained through the proper proportioning of the parts of any whole." Proportion, on the other hand, is "the principle which deals with the relationship of the size of one part to the whole."[13]

Harmony and Rhythm

The term harmony, as it relates to product design, means how well certain design elements such as colors, materials, lines and shapes blend together or complement each other. Rhythm, on the other hand, can be described as the unbroken flow of design elements and a structured pattern which blend the different design elements together.[14]

APPENDIX O

The Design Process (Defined)

Unlike professional designers, the beginners in design may find it difficult to take on a particular design task because they lack the experience, exposure and an organized procedure to guide them. For this reason the students should be introduced to a planned process which will help organize their thoughts and aid them in developing ideas. This process is not a rigid mathematical formula but a flexible procedure that is used by professional designers as well. Most experienced designers have developed some type of systematic technique which is used to initiate and explore their design ideas.

The following seven steps are to be used in the execution of a design problem. These steps are presented in a logical sequence in an attempt to make designing easier and more meaningful. They are used in the problem solving process which will exemplify a method for designing. The steps are:

1. Identify the problem and its limitations.
2. Analyze and research the problem.
3. Develop possible ideas.
4. Analyze your possible solution.
5. Refine the possible ideas.
6. Analyze and experiment with your ideas.
7. Develop a final solution.[15]

The problems presented later in this guide call for the development of creative ideas which are to be conveyed through sketches. It is hoped that the students will use the design process in aiding them in practicing a step-by-step procedure in reaching a creative solution. The example problem which follows will exemplify the use of this process and the illustration of an idea.

Let us take a closer and more detailed look at each phase of the design process.

Statement of the Problem

A designer must establish a clear and concise statement of what the problem is, what you are trying to accomplish, and then set out to solve it. With the objective (statement of the problem) clearly established, the designer's attention can now be focused on solving that particular problem. State the problem in simple, concise terms. For example, design and construct a pair of candle holders that would be constructed from 2" X 2" X 6" stock and turned in the wood lathe.

Figure 1 shows an example problem that calls for the design of the exterior form of a candle holder. The designers must first recognize the problem. Then they must identify any limitations that may be involved. For example, the designer must be aware of certain considerations such as, materials to be used for construction, minimum and maximum dimensions, candle size and certain machine operations. These limitations could be either dictated by the problem or formulated by the designer, but in either case the problem and any limitations must be kept in mind throughout the designing process.

Analysis and Research of the Problem

At this point, the designer should also be aware that there are certain limitations in regard to functional, material and visual requirements that must be considered. These requirements and limitations must also be recognized, established and kept in mind while creating solutions to the problem. With these requirements and limitations established, the designer can begin visualizing a workable solution to the problem. An example check list of these requirements and limitations is:

Functional Requirements and Limitations

a. Must hold candle in an effective and safe manner.

b. Must be constructed to have sufficient stabiliy.

c. Must not scratch a table top.

d. Diameter of candle to be used.

Material Requirements and Limitations

a. This candle holder could be constructed of a variety of materials, unless a particular one was specified by the problem. However, any material or combination of materials must be utilized in an effective manner and add to the overall appearance and stability of the design.

b. Turned in the wood lathe 2" X 2" X 6" maximum size.

Visual Requirements and Limitations

a. Must be visually appealing.

b. Must have a simple, uncluttered appearance.

c. Must have a contemporary or traditional appearance.

Before beginning work, the designers may wish to conduct some basic research. They may begin their research by confronting themselves with various types of existing designs, by reviewing current publications, or they may approach the problem of research by using mental recall (association), of shapes or forms that have been observed in the past. Each of these research devices could aid the designer. The above examples are only a few of the many ways the designers could prepare themselves to embark upon a design task.

Possible Solutions

Figure 2 illustrates how ideas for the candle holder design could be presented in the form of freehand sketches. Note the progression of the forms and the utilization of different basic shapes. Shapes such as the square, ellipse, circle and triangle are used in search of a truly unique form. These sketches are drawn quickly and are only a record of a fleeting idea. However, if you find a particular design more appealing, take a few extra minutes and illustrate it more completely.

Figure 2 also is an example of how the possible solutions could be executed for maximum effectiveness in visualizing a specific styling idea. It serves to record your ideas that will be used when you approach the refinement phase of this process. The designers should formulate as many ideas as they can in the allotted time because they will be evaluated on the number of responses they have been able to sketch. Also, the more ideas you have will increase the chances of good ideas. To help the designers generate ideas, they should use idea-production techniques such as: 1. Basic shapes; 2. Scribble; 3. Study of nature; 4. Forced relationships; 5. Partial design; and 6. Check listing.

Analyze the Possible Solutions

After completion of the possible solutions, the designers should take a few minutes to evaluate their progress. They should determine which of the ideas that have developed meet the requirements and limitations that were set forth in the beginning. These ideas should be selected and carried over for refinement.

Refined Solutions

Figure 3 illustrates how a few ideas that were conceived during the possible solution phase, which seem to possess the most promise, can be modified, refined and rearranged into a totally new solution. The designer will find that by simply changing the proportions such as height, thickness or line curvature, a much better and more appealing solution to the problem may be discovered. When developing refined ideas, sketching and shading are very important and should be executed to the best of the designer's ability. The designer may wish to add notes to explain a particular idea. Through this form of communication the designer can actually see how something that was only an idea a few moments ago could possibly look if actually constructed.

Analysis of Refined Solutions, Testing, Mock-Up

Upon completion of the refinement of ideas, you must again formulate a decision about the best solution to the problem. It is not uncommon for a designer to have several solutions that would be equally efficient and visually appealing. However, a choice must be made. To help in this choice the designer may wish to test the idea in some way or develop a mock-up of that idea.

Final Solution

The last phase of this process calls for the designers to choose from their many sketches the idea they feel is best. This may become a problem within itself because many times there will be several good solutions. The designer is to take this final idea and present it in the form of a professional working drawing or sketch.

Figure 4 serves as an example of how the final solution may be illustrated for maximum effect. If the final sketch or drawing is executed properly, it could serve as a plan to be followed during the actual construction of the design.

FIG. 1

DESIGN

PROBLEM

Given two pieces of wood that are 2" X 2" X 6" in size, design the exterior form of a pair of candle holders.

LIMITATIONS

The maximum size of the candle holder is 2" X 2" X 6". The final design would be turned in the wood lathe and a standard ½" diameter candle will be used.

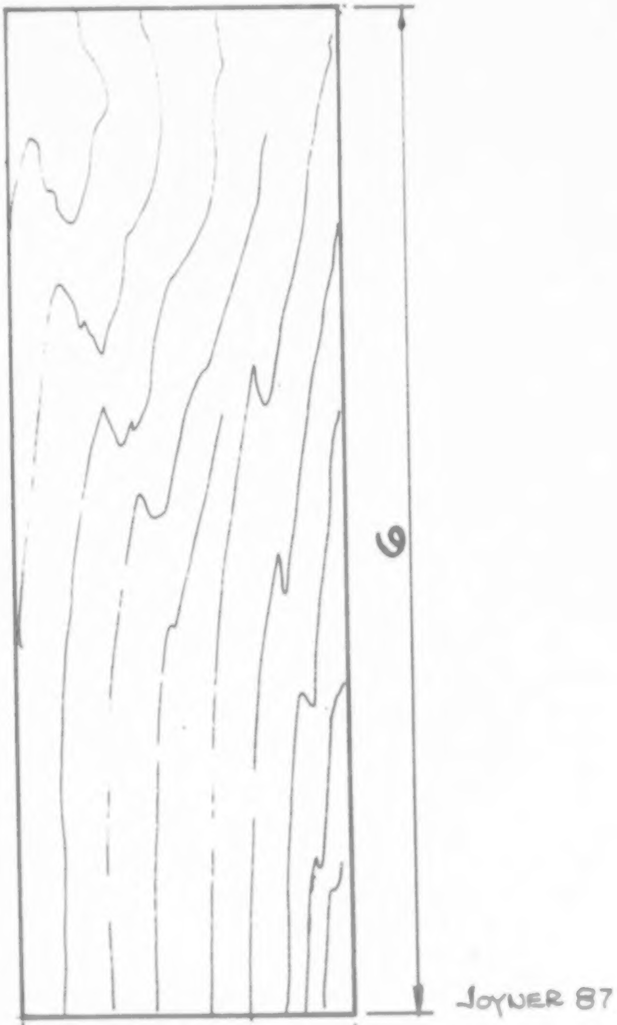


FIG. 2

POSSIBLE SOLUTIONS

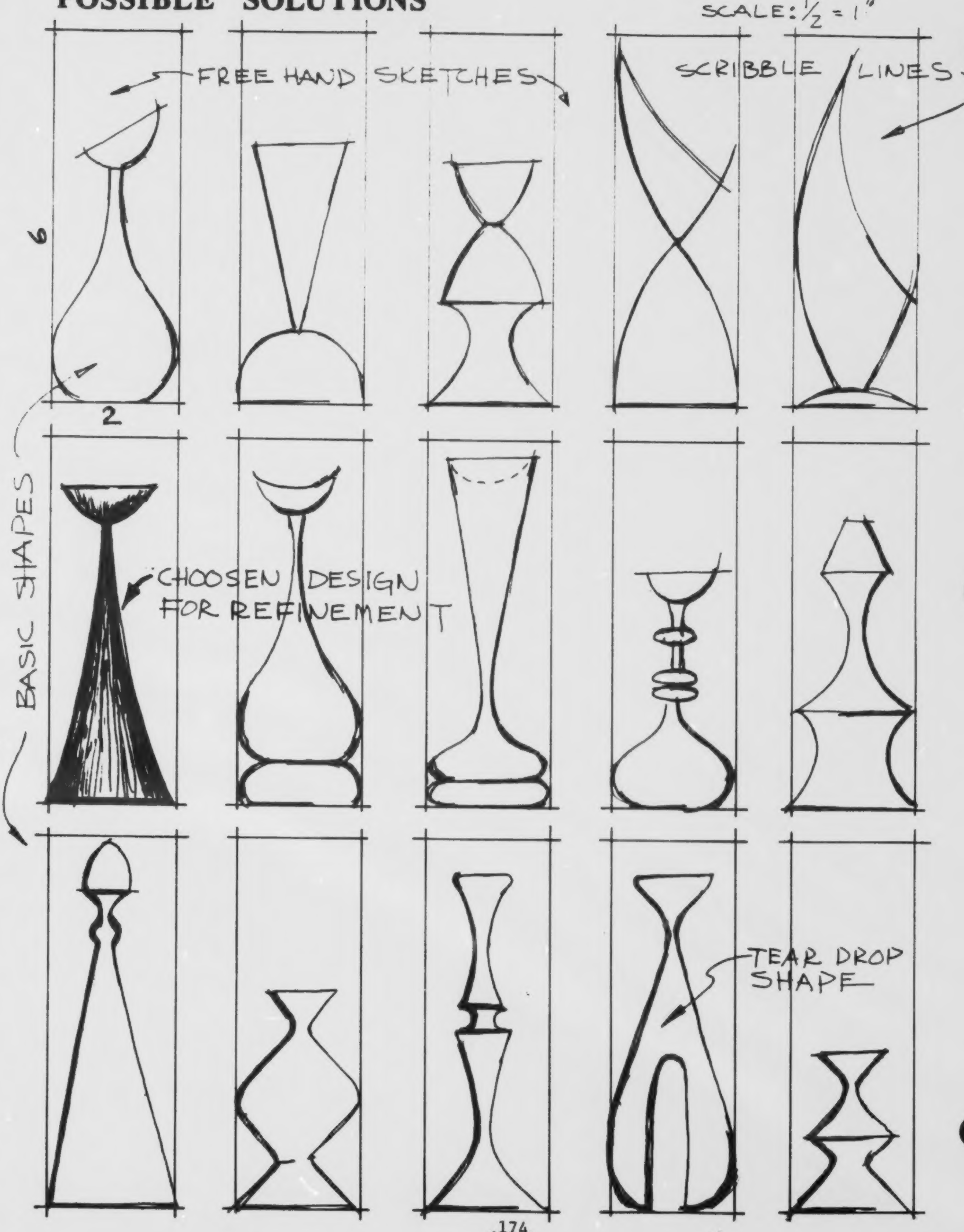

SCALE: $\frac{1}{2}$" = 1"
FREE HAND SKETCHES
SCRIBBLE LINES
6
2
BASIC SHAPES
CHOOSEN DESIGN FOR REFINEMENT
TEAR DROP SHAPE

FIG. 3

REFINED SOLUTIONS

SCALE: $\frac{3}{4}'' = 1''$

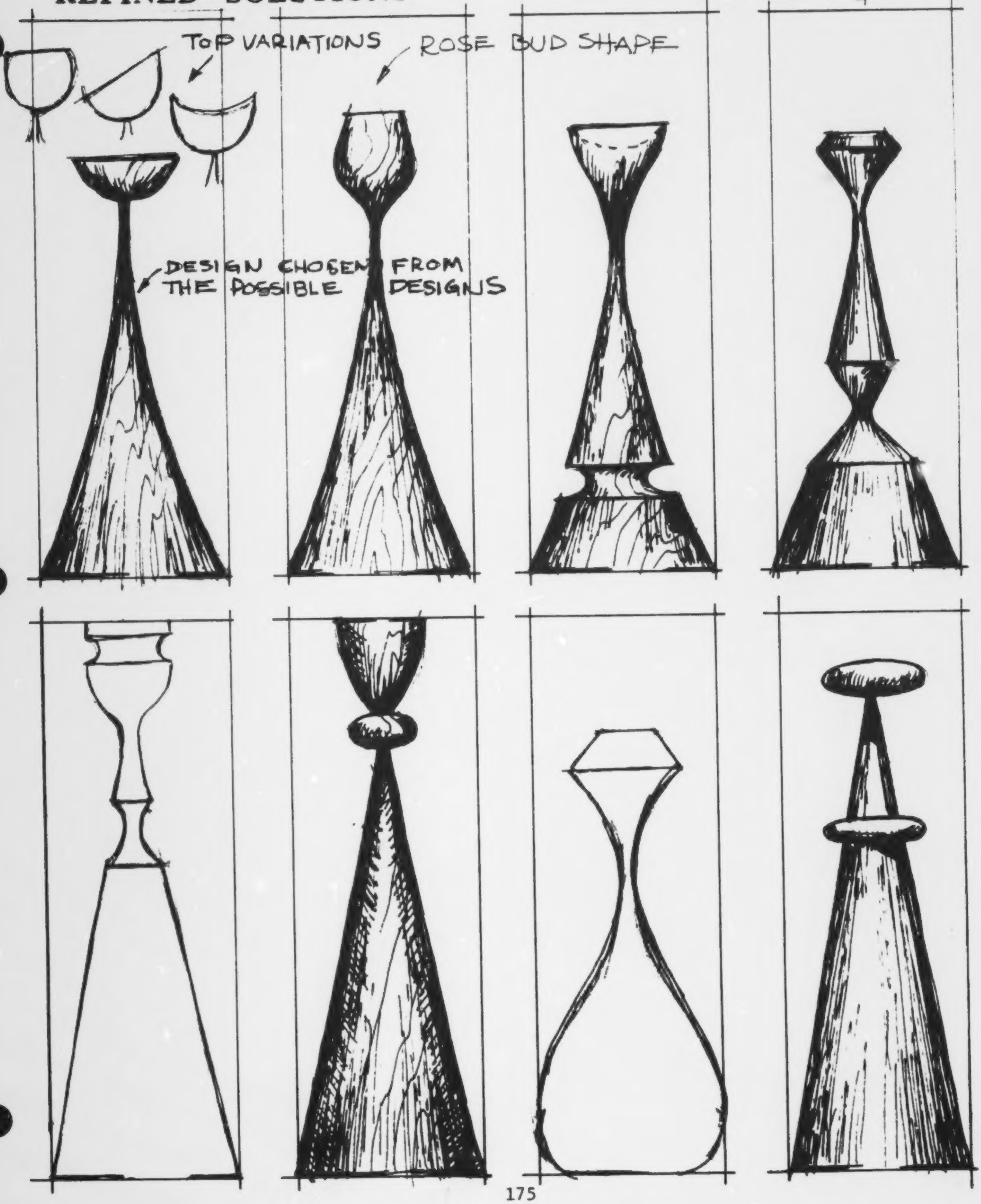
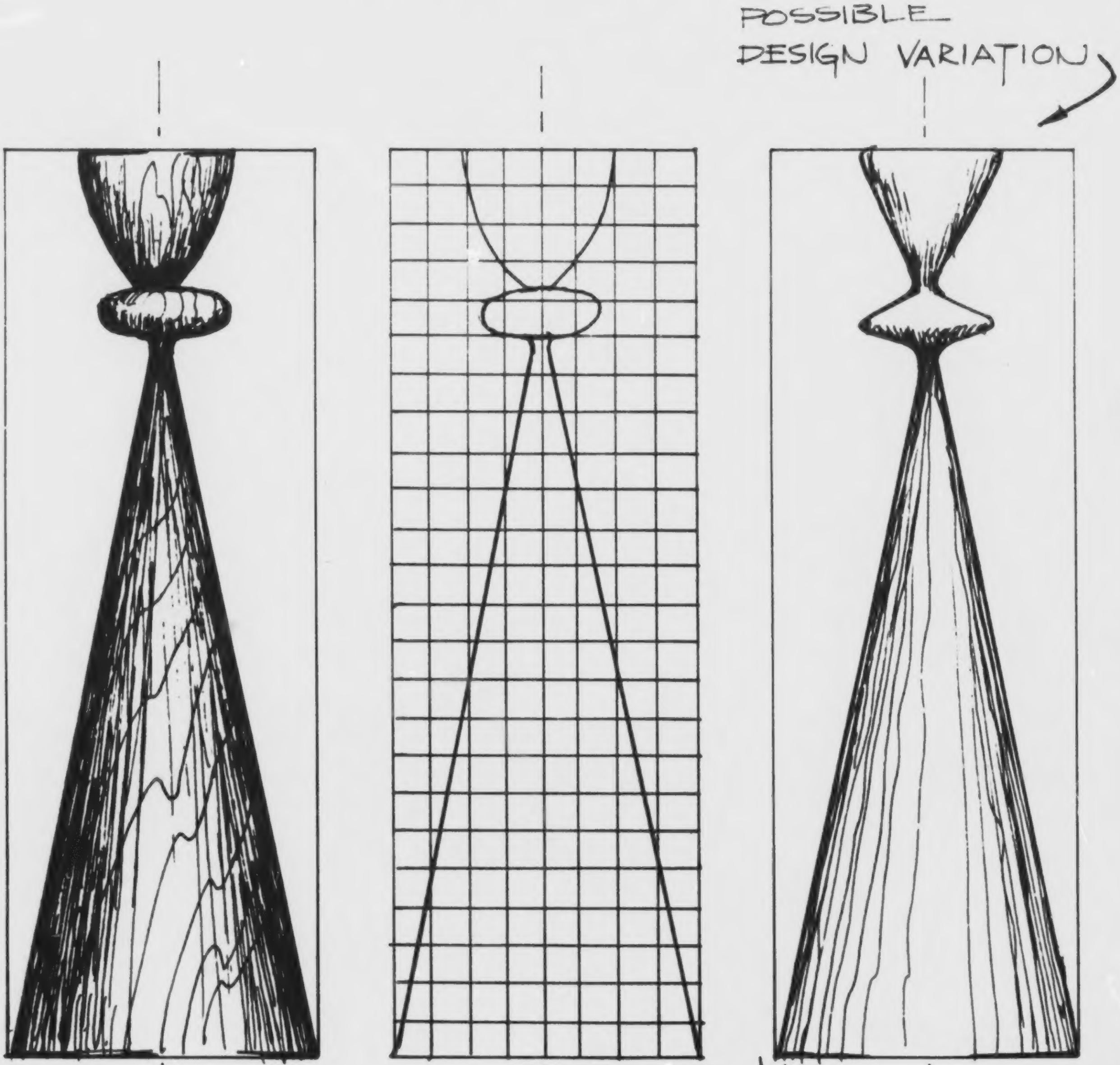

TOP VARIATIONS
ROSE BUD SHAPE
DESIGN CHOSEN FROM THE POSSIBLE DESIGNS

FIG. 4

FINAL SOLUTION

FULL SCALE


POSSIBLE DESIGN VARIATION
EACH SQ. = 1/4"

APPENDIX P

Idea Production Techniques

Association

When the mind makes a relationship or uses previous encounters and knowledge. For example, you may use something you have seen, touched, smelled, tasted or heard, in helping develop a design idea or concept.[16]

Basic Shapes

The circle, square and triangle. All shape or form had its origin in one or a combination of these three basic shapes. The designer may use these shapes or a modification of these shapes to help develop the unique shape or form of an object.

Scribble

Is a graphic technique used to develop unique free form. The technique consists of using a pencil to scribble lines on a piece of paper and then analyzing the forms that are created for possible use in a design.

Forced Relationship

Is the idea producing technique which forces a relationship between two or more uncommon or dissimilar objects. For example, forcing a relationship between a window blind and a lamp, might spur an interesting design concept.[17]

Partial Design

Is the use of an existing design or idea and only redesign part of the existing design. The original design is what serves as the starting point in idea development.[18]

Idea Checklist

Helps the designer record possible ideas for future reference or records a plan of procedure. It is much like a shopping list which helps people find items quickly and accurately without wandering around wasting time and energy. For example, if you were trying to decide on what material to use for a design, you could make a checklist of possible materials or combination of materials and then explore their possible uses one at a time to see if they might be appropriate for that design.[19]

Brainstorming

Brainstorming is a group problem solving or idea producing technique.

This technique is an excellent way for a group of people to focus their attention and creative ideas for the solution of a common problem.

There is a structured way a brainstroming session should be conducted and anyone wishing to review a detailed description should refer to the book Applied Imagination, Chapters 12 and 13.

In brief, a brainstorming session should involve the following:

1. A group of seven to twelve people with everyone feeling comfortable with each other.

2. Have some way of recording the ideas that are presented by the group.

3. Have a leader who conducts the session.

4. The topic or problem should be clearly stated and specific. If the topic is too broad it will need to be broken down into separate topics or problems.

5. Defer judgement until later.

6. Follow the rules of a brainstorming session. They are:

   a. All criticism is withheld.

   b. Freewheeling is welcome. The wilder the idea the better.

   c. Quantity is sought. The more ideas the better chance you have of developing useable ideas.

   d. Combination of ideas and improvement of ideas is stressed. Use other ideas to develop your own.

7. Use a relaxed atmosphere for the session.

8. Conduct the session, with group members offering suggestions in an orderly manner.

9. Session length should be about thirty minutes or until the ideas stop coming easily.

10. The group should meet again in a day or two. At that time, each suggestion should be analyzed. These ideas could be accepted, combined with other ideas, kept for future reference or discarded as not acceptable.[20]

Bionics

Is the use of nature and the special devices found in both plants and animals to solve the special survival problems of the living creatures. Applying nature to design helps one create unique shapes and forms, color, texture and structure.[21]

Synectics

A process to help us look at problems in different and creative ways. Synectics makes the strange seem familiar and the familiar seem strange. For example, look at something upside down, stretch it, cut it in half, fold it, look at it in dim light, change its color and you are using synectics.[22]

Redesign

A process by which the designer produced ideas by analyzing and redesigning an existing design. The designer can analyze, criticize, use it, take it apart, reassemble it, and improve it by modifying it.[23]

APPENDIX Q

Cognitive Creative Abilities

E. Paul Torrance, in his book Torrance Tests of Creative Thinking, describes four abilities that are measurable and are possessed by creative thinkers. These four creative abilities can be used to measure idea production phases of the design process. These four creative abilities are:

Fluency
The ability to produce a large number of ideas in an allotted time span. To evaluate a person's fluency, just count the number of valid responses the designers have made relevant to the problem.

Flexibility
The ability to produce a wide variety of responses relevant to the problem. The ability to switch trains of thought, change approaches, or use different strategies. To evaluate flexibility, note and record the number of different approaches the design students may have used. If most of the responses are similar, then the designers not very flexible in their thinking.

Originality
The ability to produce uncommon responses. The ability to deviate from the normal, obvious and established ways of thinking. Originality can be evaluated by noting how different or unique a design solution may be in relation to what is common place.

Elaboration
The ability to develop, carry through, expand upon, add detail to, or elaborate on a particular design task or idea.

To evaluate elaboration, one must notice how much the designer has elaborated or expanded upon a particular idea or task.[24]

The teacher can evaluate the idea production phase of the design process in terms of fluency, flexibility originally and elaboration. Each of these four catagories should be worth a certain number of points and the instructor can decide what each area deserves in relation to the criteria.

APPENDIX R

Example Design Problems I & II

Example Design Problem I

I. Introduction:

To design and construct a CO dragster has captured the imagination and interest of the students. This project is an excellent means to teach basic design and construction fundamentals.

II. Problem:

You are the designer, design the shape of a CO_2 drag racer to be constructed of soft wood. You must stay within the limitations provided.

III. Analysis and Research:

This phase of the design process is very important. This is where the designer must try to identify any limitations that would effect the outcome or final solution to the problem.

For this problem, there are several limitations that must be satisfied to achieve a successful design. These limitations are:

LIMITATIONS:

In most design situations there are certain limitations or requirements that must be met. For example, size and structure must be evaluated. Review the limitations carefully and stay within the regulations set forth by the problem.

IV. Possible Solutions: (Rough Sketches)

Use the sheets provided to develop possible styling ideas. This sheet has the front, side, top and rear elevations which could be used to establish the entire shape of the race car.

V. Analysis of Possible Solutions:

After you have developed several ideas, you must analyze those ideas and choose the idea or ideas that seem to have the most promise. Your analysis should be in regard to the limitations set forth, function, material and visual effect. Choose what you think is your best possible solution and transfer it to the Refined Solutions sheet. Take that one idea and try to make it better. Refine it and make adjustments where you feel they are needed.

VI. Refined Solutions: (More Refined Sketches)

Refine your best possible idea. Use the sheets provided to develop or explore this idea further. Take a little more time to sketch or draw the refined ideas.

VII. Analysis of Refined Solutions: (Testing Mock-Up)

Review your refined ideas and choose the idea you feel is best. Use a piece of 1 5/8" X 2 3/4" X 12" lg. styrofoam, that is provided in the Pitsco Inc. Kit, to cut and sculpture a mock-up of your chosen idea. Review the results and analyze the mock-up in regard to the limitations. Remember the functional, material and visual requirements must be satisfied.

VIII. Final Solution:

Develop a full size orthographic drawing of your final solution. This drawing will be used as a pattern in the construction of your prototype. Also, develop pictorial sketches and render in ink and color pencil. After the development of the working drawings and renderings, construct a full size prototype of the final design solution. The class may wish to have a racing competition to see who has developed the best racer. There could also be a competition to see who has developed the best styling and craft work.

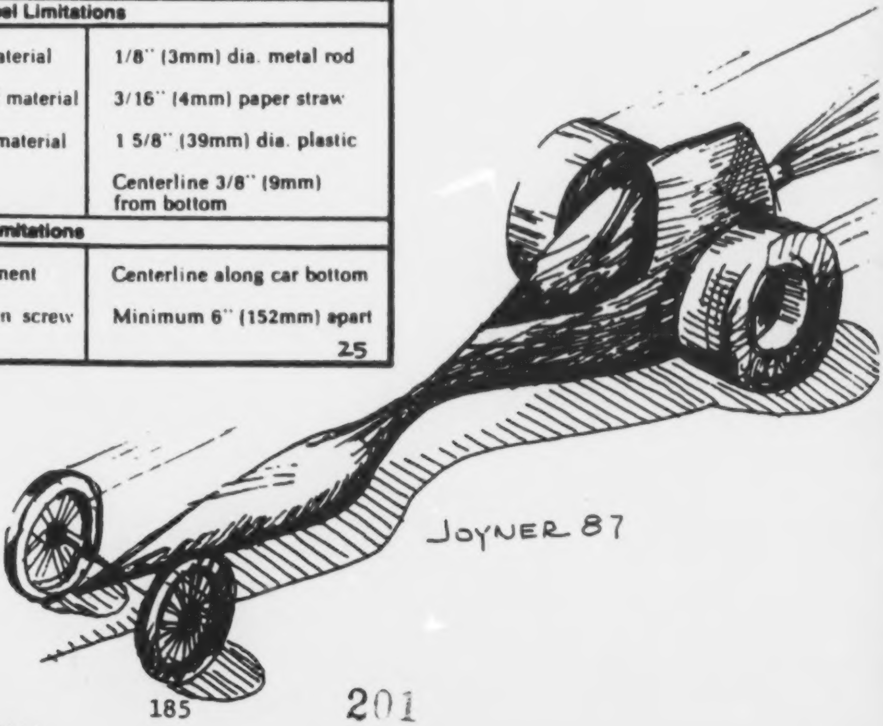
DESIGN

PROBLEM

You are the designer; design the shape of a CO_2 drag racer to be constructed of soft wood. You must stay within the limitations that are provided. Use the attached sheets to sketch and draw your design ideas. Be creative in yourthinking.

LIMITATIONS

Factors	Limitations
Body Limitations	
Length	12" (300mm)
Width	1 5/8" (42mm) maximum
Height	2 3/4 (70mm) maximum
Shape	3/8" (10mm) min. diameter
Axle housing	Axels must be enclosed
Color	Your choice
Material	Soft wood
Power Plant Limitations	
Size and material	Metal cartridge
Location	1 1/4" (32mm) from bottom of car to center
Housing size	Totally enclosed with 1/8" (3mm) mininimum thickness around cartridge
Axle, Bearing, Wheel Limitations	
Axle size and material	1/8" (3mm) dia. metal rod
Bearing size and material	3/16" (4mm) paper straw
Wheel size and material	1 5/8" (39mm) dia. plastic
Axle location	Centerline 3/8" (9mm) from bottom
Steering System Limitations	
Screw eye alignment	Centerline along car bottom
Distance between screw eyes	Minimum 6" (152mm) apart



JOYNER 87

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CO_2 DRAGSTER

The CO_2 dragster competition will be divided into three classes for the 1987 Technology Fair. They are "Stock", "Unlimited", and "Teacher". The rules for each class are as follows.

*** A STUDENT MAY ENTER ONLY ONE CLASS AND ONE CAR IN THAT CLASS***

The CO_2 dragster competition is open to any student. You, as the Industrial Arts Teacher, may wish to invite the other teacher(s) and their students to participate in the contest.

STOCK

Body Limitations	Minimum	Maximum
1 Length	12"(300mm)	12"(300mm)
2. Width (Between Wheels)	1 5/8"(42mm)	1 5/8"(42mm)
3. Height	2 3/4"(70mm)	2 3/4"(70mm)
4. Shape	3/8"(10mm) Dia.	1 5/8"(70mm)
5. Axle Housing	Axles must be enclosed	
6. Color	Your Choice	
7. Material	Soft Wood one piece	

Power Plant Limitations

1. Size	CO_2 Cartridge Brand D
2. Location	1 1/4"(32mm)from bottom of car to center
3. Housing size	Totally enclosed with 1/8" (3mm) minimum thickness around cartridge

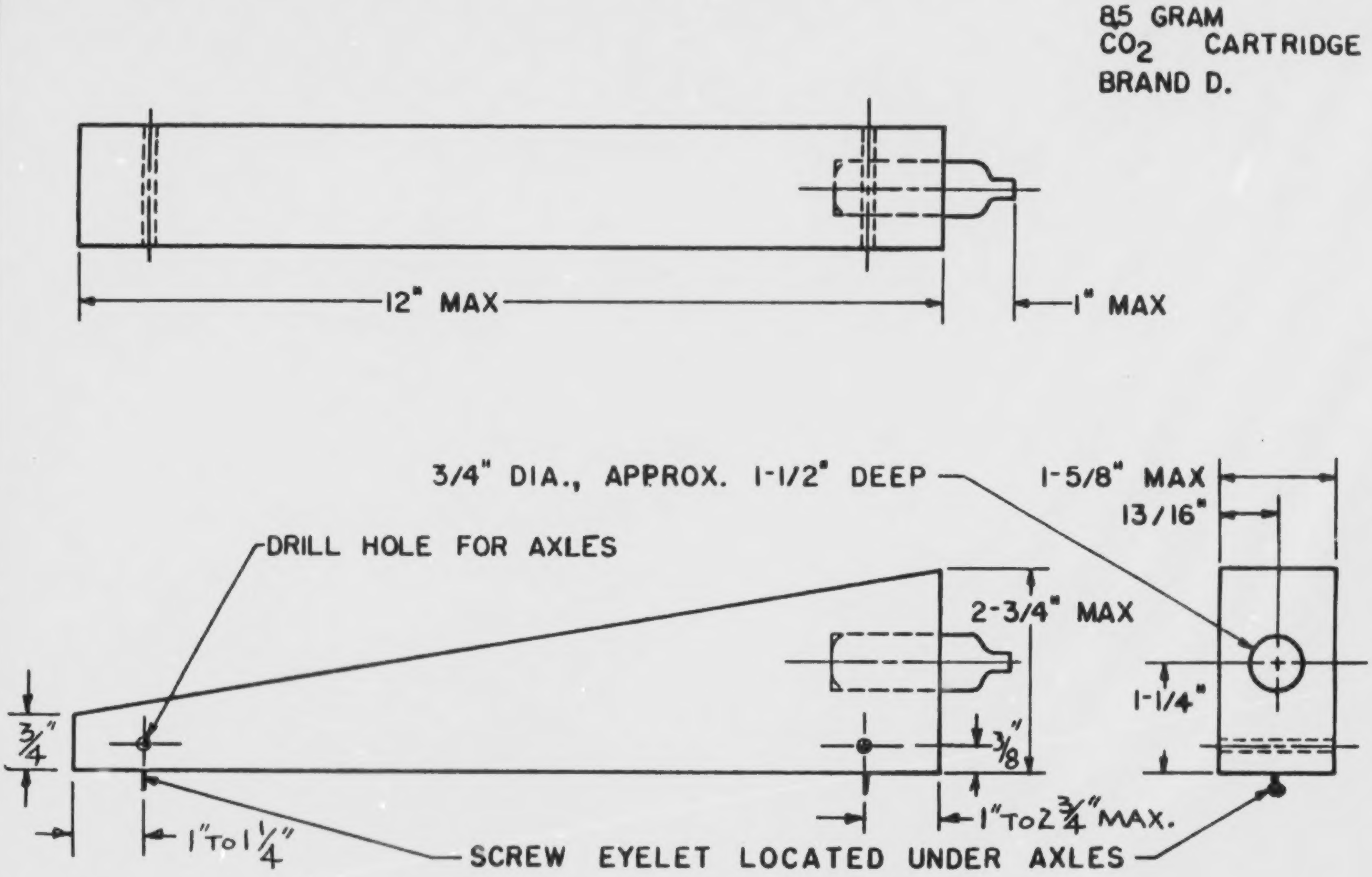
Axle, Bearing, Wheel Limitations

1. Axle size,Material, and Location	1/8"(3mm) Dia. X 2 1/2" metal rod 6" to 10" apart and about 3/8" from the bottom of the body.
2. Bearing size and material	3/16"(4mm) straw
3. Wheel size and material	Front: 1 5/8" (39mm) Dia. X 3/16 (5mm) Rear: 1 5/8" (39mm) Dia. X 3/4" Material: Plastic

Steering System Limitations

1. Screw eye alignment	Centerline along car bottom
2. Distance between screw	Minimum 6"(152mm) apart

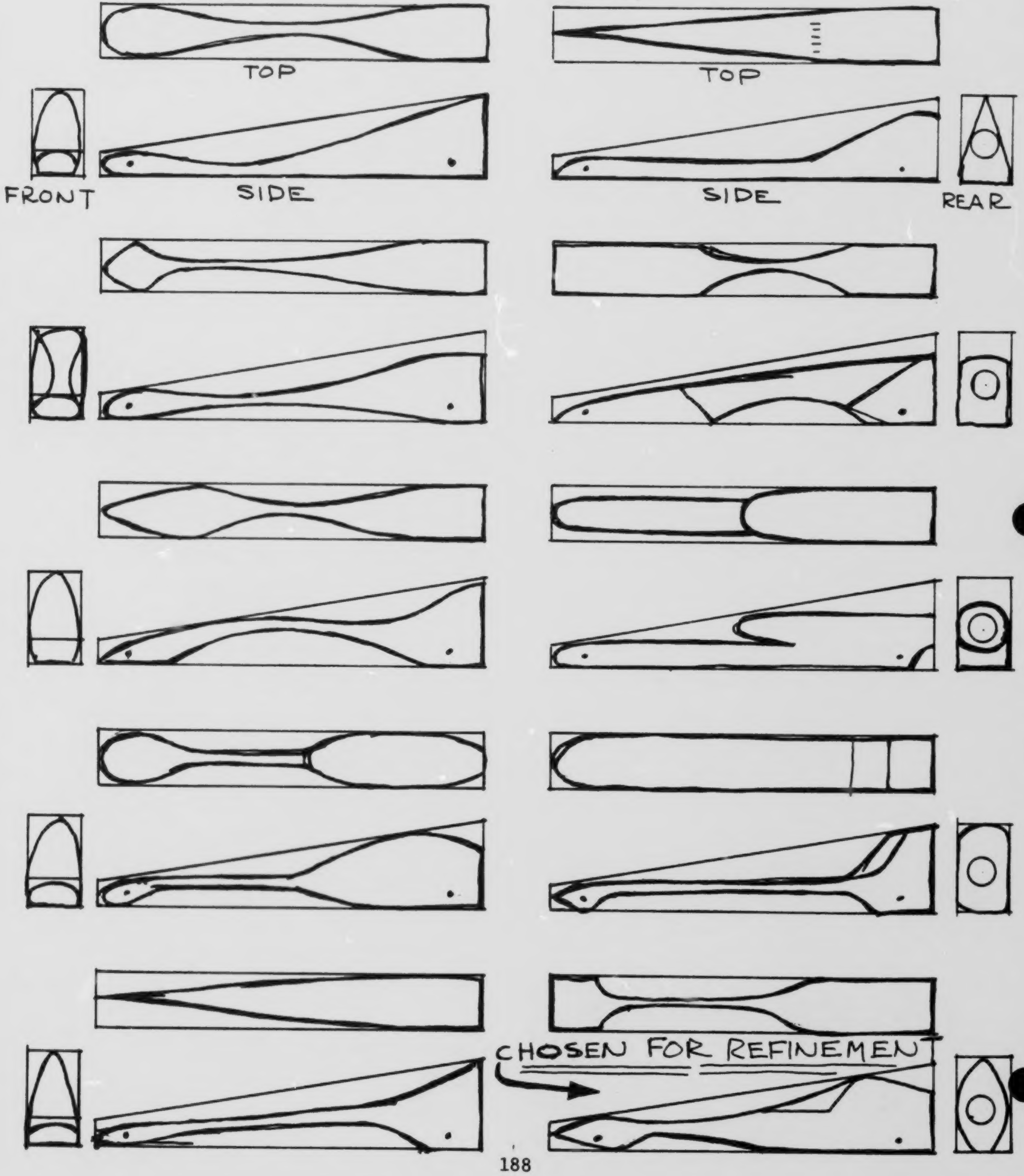
*** The stock dragster must use the materials that are furnished with the PITSCO Dragster Kit or like materila. 25


85 GRAM
CO_2 CARTRIDGE
BRAND D.
12" MAX
1" MAX
3/4" DIA., APPROX. 1-1/2" DEEP
1-5/8" MAX
13/16"
DRILL HOLE FOR AXLES
2-3/4" MAX
1-1/4"
3/4"
3/8"
1" TO 1 1/4"
1" TO 2 3/4" MAX.
SCREW EYELET LOCATED UNDER AXLES

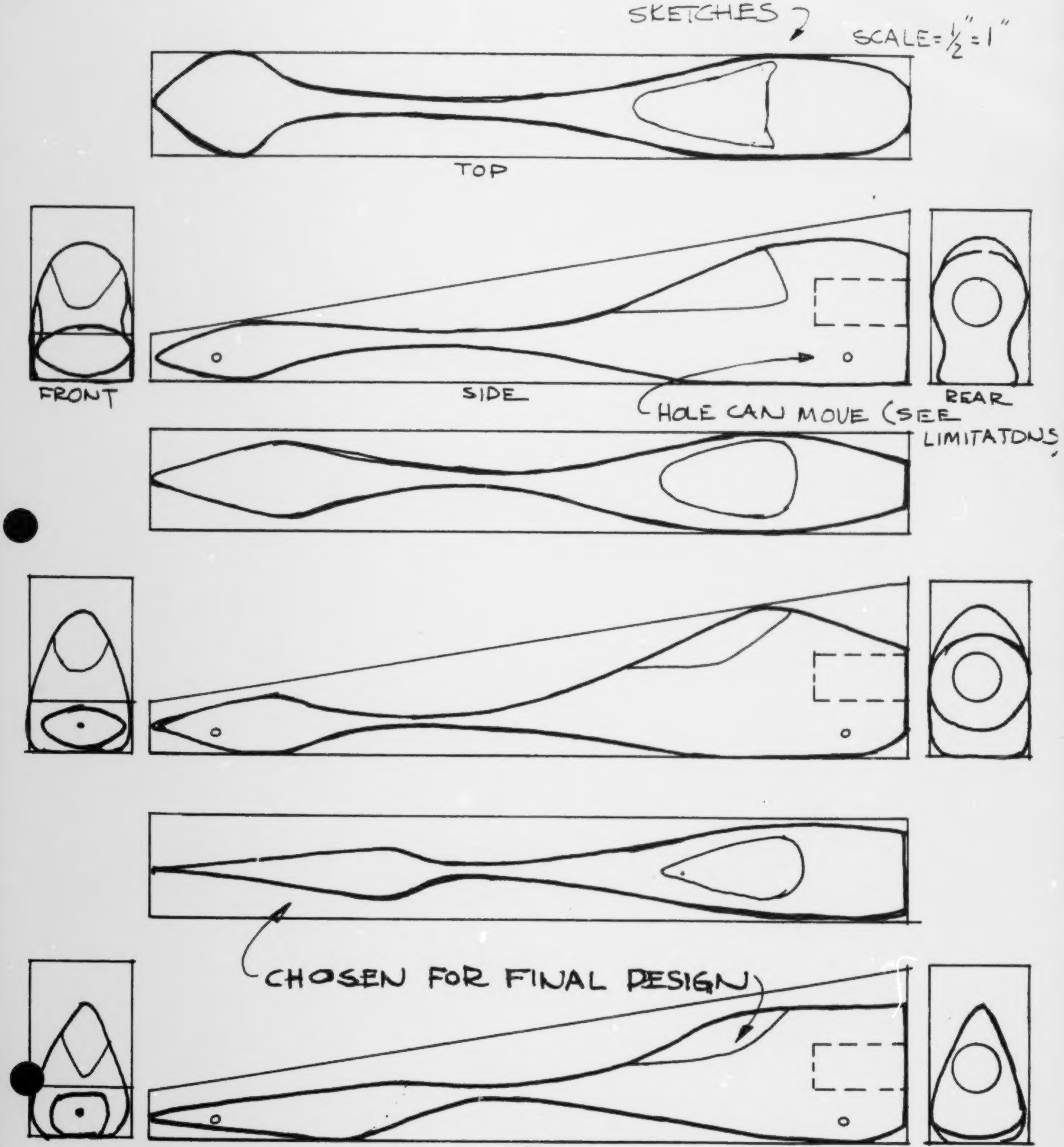
SCALE 1/2" = 1"

POSSIBLE SOLUTIONS

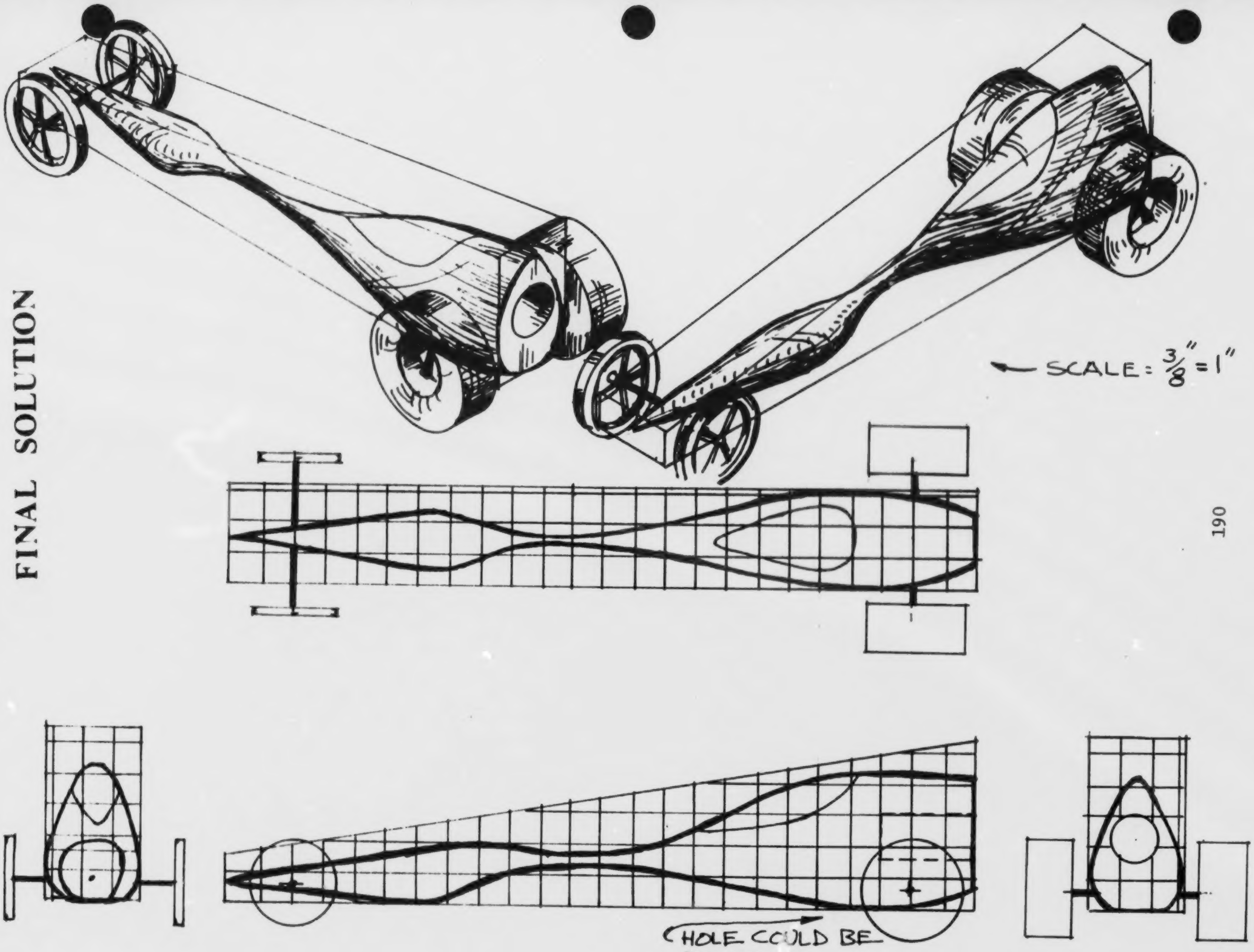
SKETCHES OF RACER'S BODY


TOP
TOP
FRONT
SIDE
SIDE
REAR
CHOSEN FOR REFINEMENT

REFINED SOLUTIONS


SKETCHES
SCALE = 1/2" = 1"
TOP
FRONT
SIDE
REAR
HOLE CAN MOVE (SEE LIMITATONS
CHOSEN FOR FINAL DESIGN

FINAL SOLUTION



← SCALE: 3/8" = 1"

HOLE COULD BE MOVED FORWARD

SCALE = 1/2" = 1"
EA. SQ. = 1/2"

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Example Design Problem II

(Graphics)

I. Introduction:

In our society graphic design and package design have become very important. In many cases the cost of the packaging exceeds the cost of the product inside. Consumer research has proven that a vast majority of consumers will buy the product that is the most uniquely packaged. A company's logo and its packaging play a very important role in portraying a company's image and identity. This is important because the consumer learns to identify with and develop trust in that product. Most companies realize the importance of well designed graphics, whether it be in the form of logos, packaging, brochures, TV commercials or catalogs, so a great deal of time and money is spent in developing good packaging and good graphics that will portray their companies' product and image.

II. Problem:

This problem has two stages. The first stage or problem is to establish a company name and design a logo for that company. The second stage or problem is to design a package for that company incorporating the logo and other graphics into the package design.

III. Analysis and Research:

At this point the designer must ask questions, such as:

1. What goes in the package?
2. What is already on the market?
3. How is it going to be reproduced (printed)?
4. What or how many colors could be used?
5. Name of the company or product.
6. Possibility of breakage.
7. What do other company logos look like?
8. Etc.

With these questions and others in mind, the designer must do the basic research to answer these questions. This research could be in the form of: looking at other company logo s, looking in stores at existing packaging, reviewing books or magazines, talking to the printer that would actually produce the final design, and most important, conducting extensive interviews with the client or company.

LIMITATION AND DESIGN CONSIDERATIONS:

At this point or during the possible solution phase of the design process, the designer may find it helpful to develop a checklist of possible graphic considerations. This checklist will help the designer analyze the various approaches that could be used to help solve the problem. A checklist such as:

1. Lines

    A. Straight
    B. Broken
    C. Dotted
    D. Dash
    E. Thick and Thin
    F. Inclined
    G. Curved
    H. Zig Zag
    I. Free Flowing
    J. Angle
    K. Over Lap
    L. Faded

2. Shapes

    A. Circles
    B. Half Circles
    C. Partial Circle
    D. Squares
    E. Partial Squares
    F. Triangles
    G. Shapes in Nature
    H. Mechanical Shapes
    I. Animal
    J. Etc.

3. Symbols

    A. Lightning
    B. Sun
    C. Arrow
    D. Heart
    E. Tear Drop
    F. Star
    G. Etc.

4. Color Possibilities

    A. Red
    B. Blue
    C. Red and Blue
    D. Etc.

5. Lettering

    A. Existing Styles
    B. Develop a New Style
    C. Horizontal
    D. Vertical
    E. At an Angle
    F. Off Set
    G. Upper Case
    H. Lower Case
    I. Use Words or Parts of Words
    J. Etc.

IV. Possible Solutions: (Rough Sketches)

Sketch possible solutions using the checklist and other idea production techniques as a guide in developing ideas.

V. Analysis of Possible Solutions:

Choose from the possible ideas, the one idea you feel has the most promise.

VI. Refined Solutions:

See how many ways you can refine that one idea chosen from the possible ideas.

VII. Analysis of Refined Solutions:

Choose from the refined ideas your best idea. To help you make your decision you could develop a scaled drawing of the design, and develop a mock-up using ink and color pencil.

VIII. Final Solution:

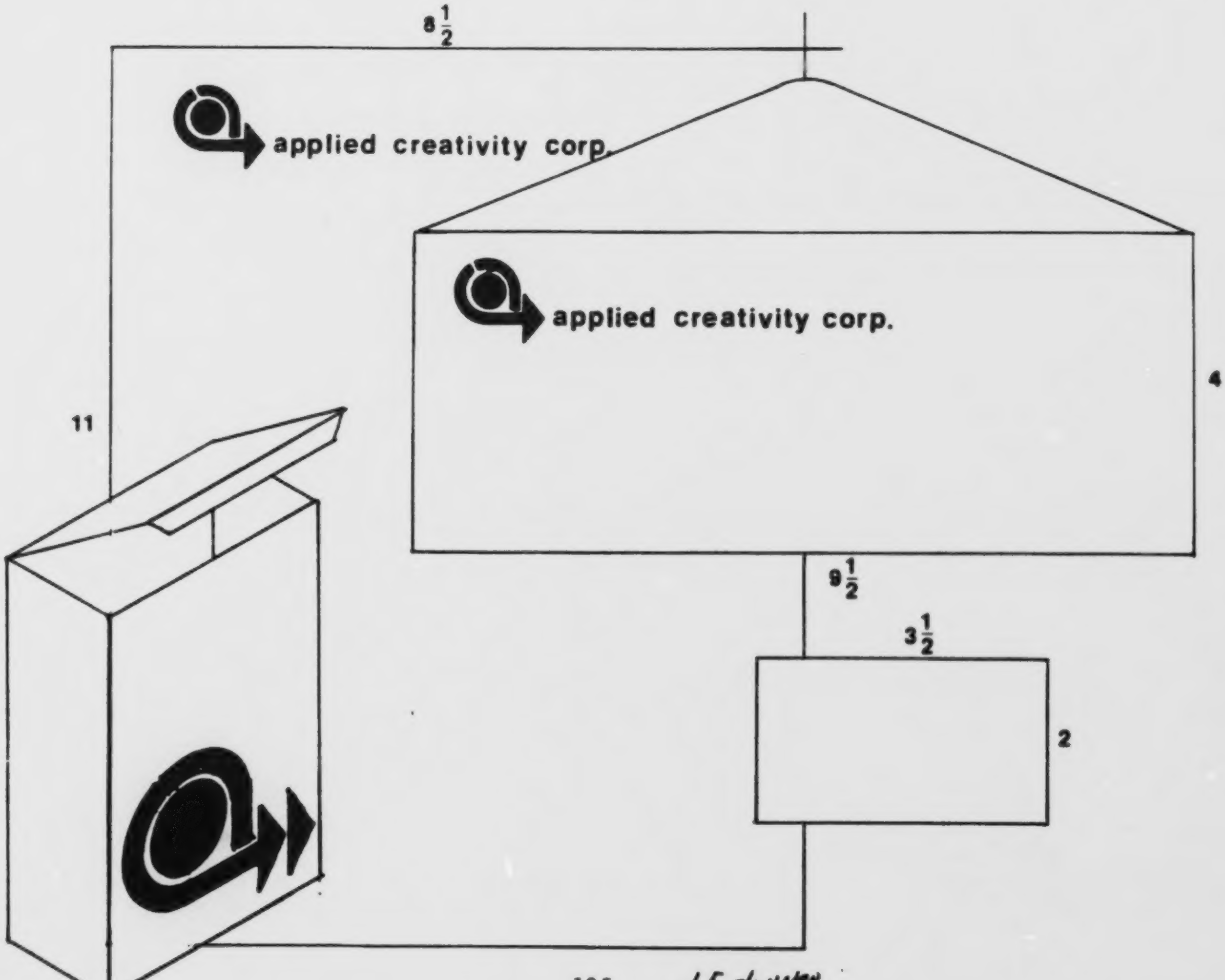
Develop an orthographic drawing of your final logo design. Render the logo design in ink and color pencil.

Draw the package design in ink and color pencil. When completed, cut out, fold and glue the package together.

DESIGN

PROBLEM

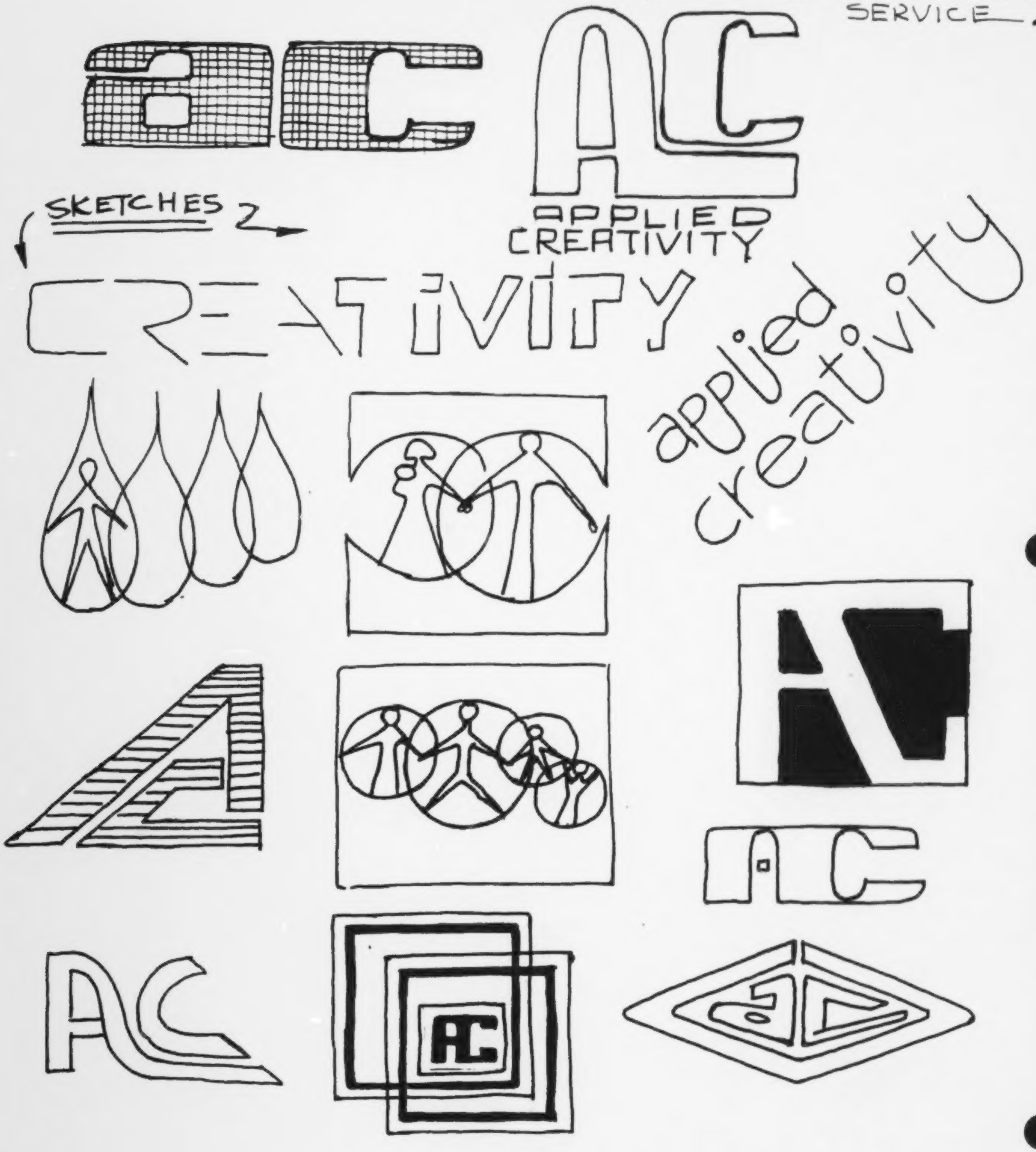
Design a logo (company symbol or trademark) for a particular company. This logo should be suitable for use on stationery, envelopes, publications, publicity materials and package design.


8 1/2
applied creativity corp.
applied creativity corp.
4
11
9 1/2
3 1/2
2

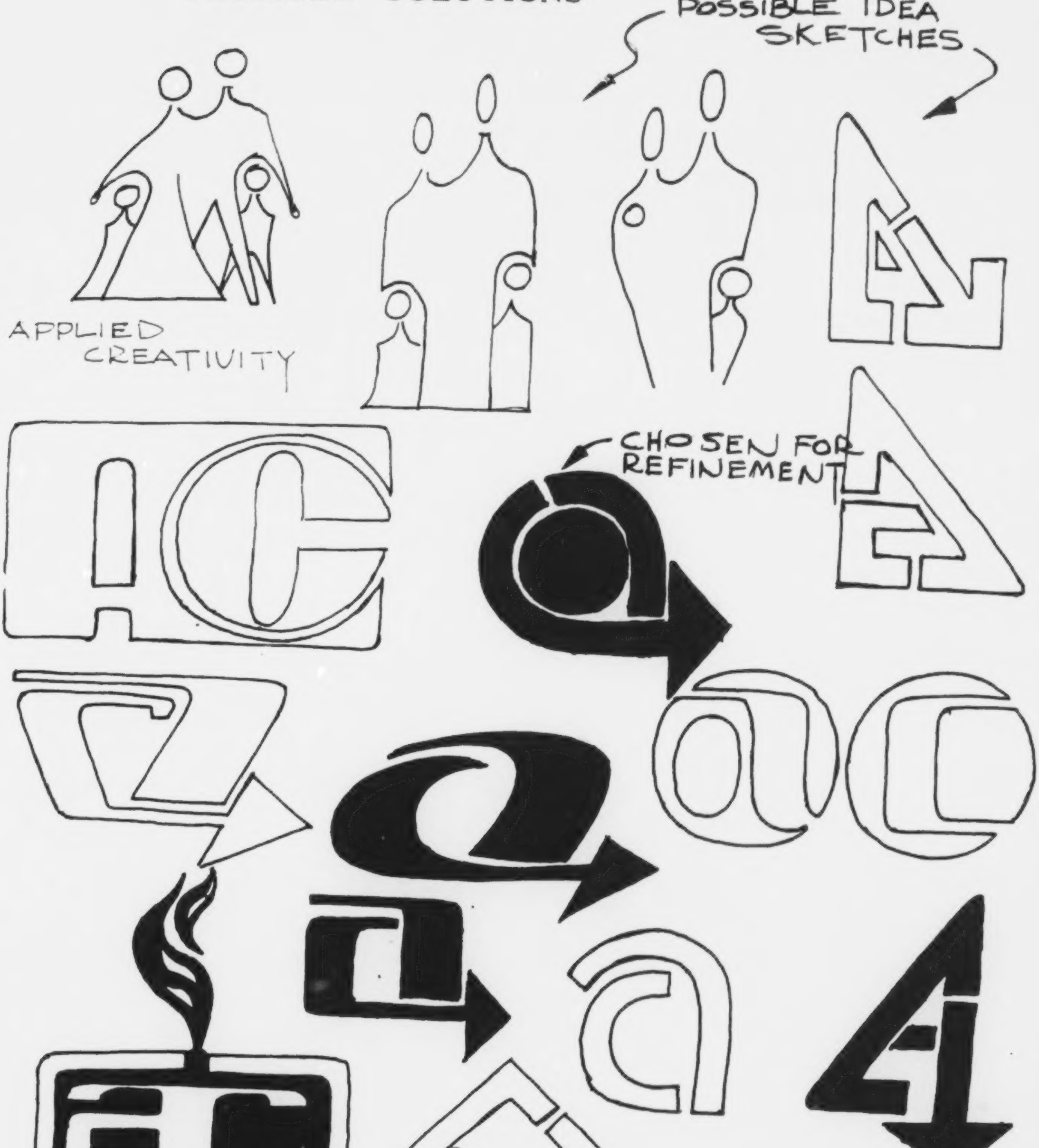
J.E. Joyner
5-11-73

NOTE: COMPANY NAME IS "APPLIED CREATIVITY." IT IS A COMPANY WHICH PRODUCES PRODUCTS AND OFFERS A DESIGN SERVICE.

POSSIBLE SOLUTIONS


ac
AC
APPLIED
CREATIVITY
SKETCHES
CREATIVITY
applied
creativity
AC
AC
AC
AC
ac

POSSIBLE SOLUTIONS

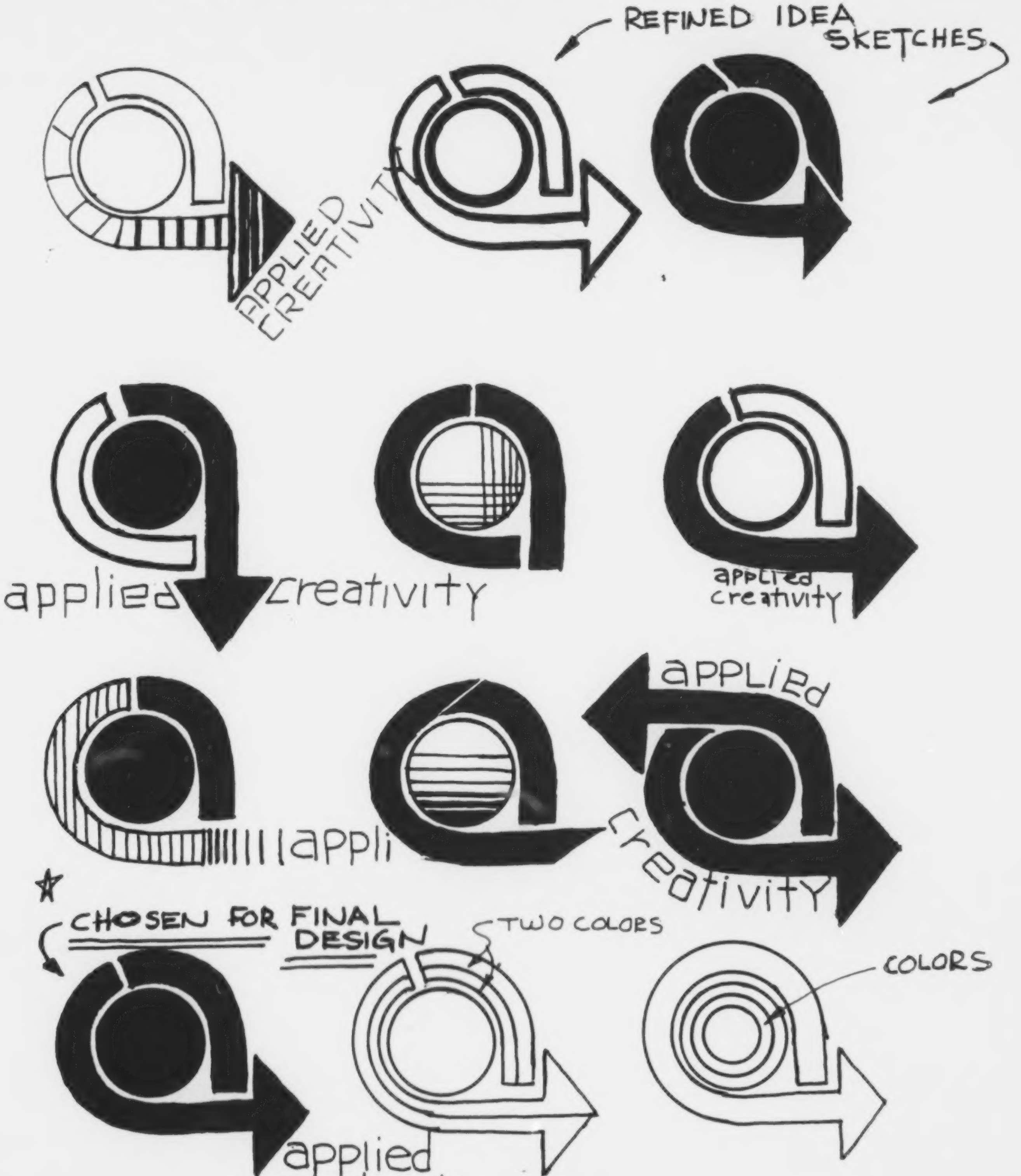


POSSIBLE IDEA SKETCHES

APPLIED CREATIVITY

CHOSEN FOR REFINEMENT

REFINED SOLUTIONS



REFINED IDEA SKETCHES

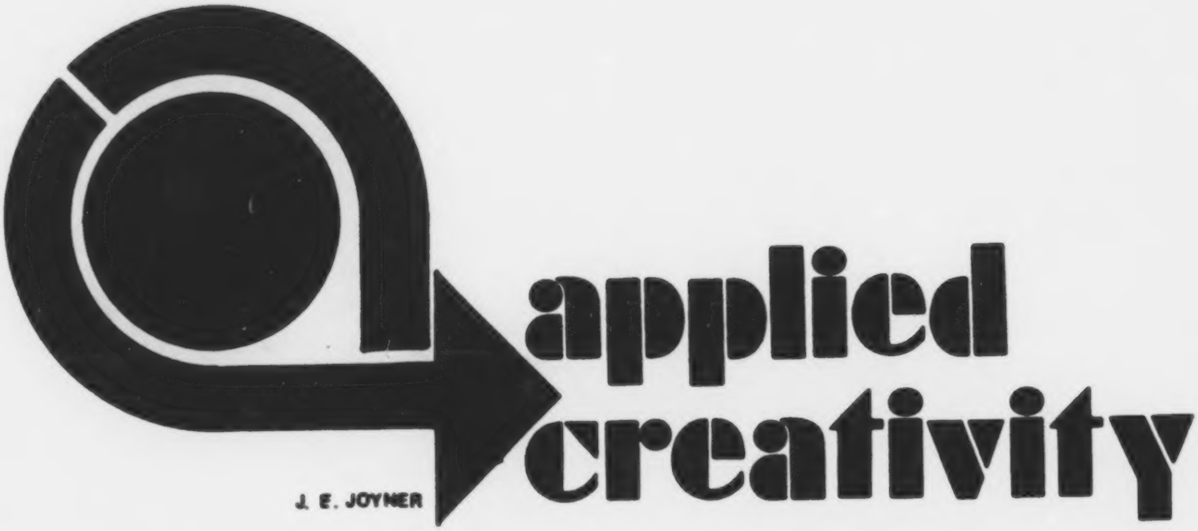
☆ CHOSEN FOR FINAL DESIGN

TWO COLORS

COLORS

APPLIED CREATIVITY
applied creativity
applied creativity
appli
applied creativity
applied creativity

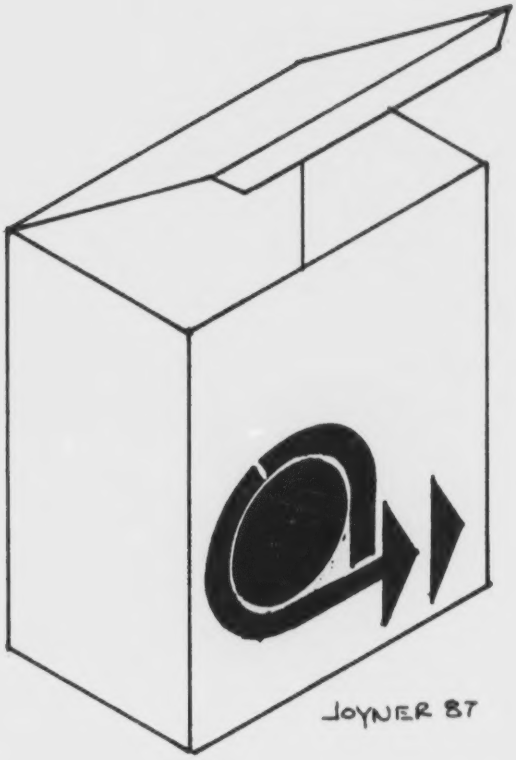
FINAL SOLUTION


applied
creativity
J. E. JOYNER

DESIGN

PROBLEM

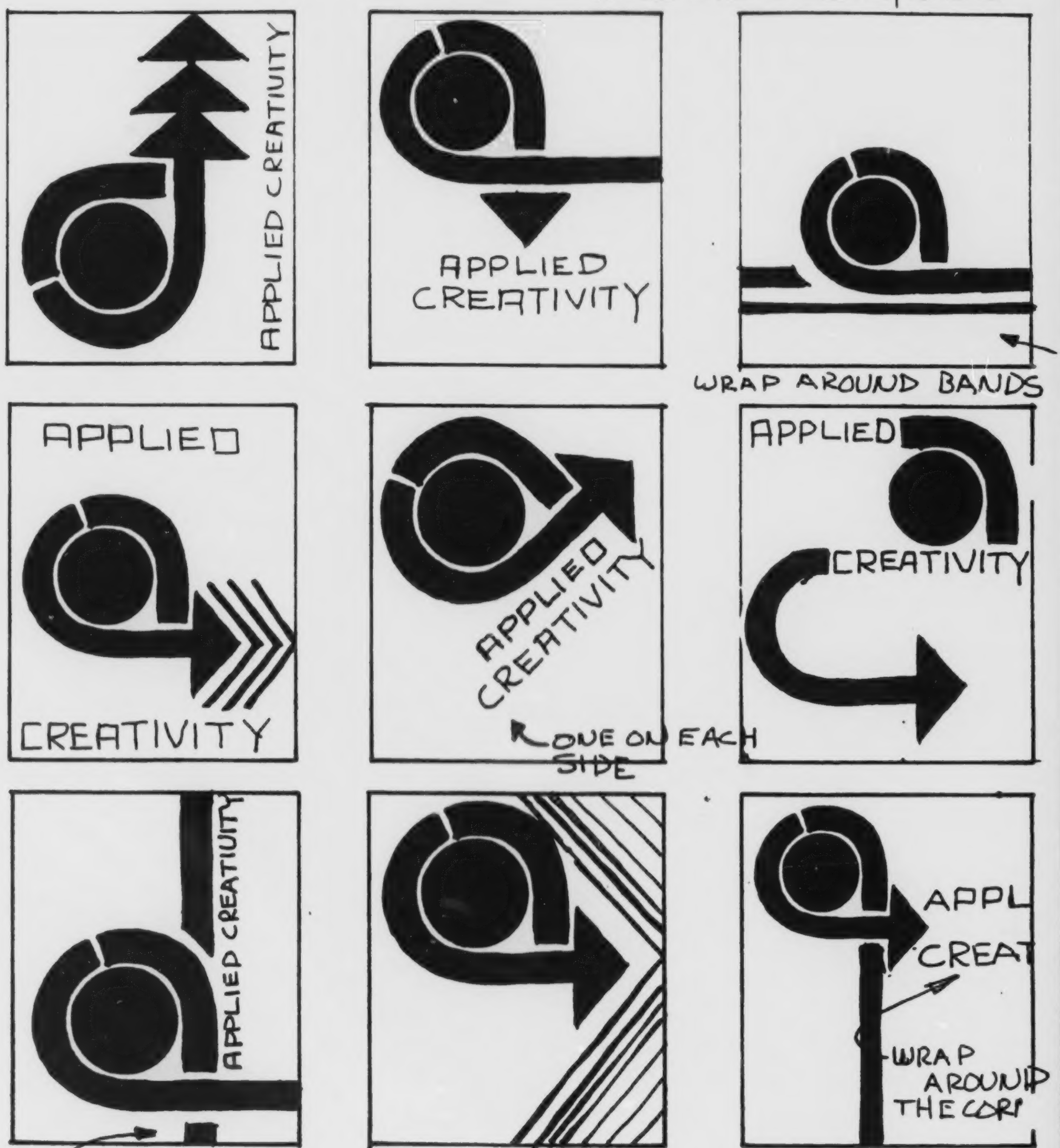
Design the package and the graphics for the package of a common consumer product. Incorporate the company name and logo into the graphics for the package. The type of product is left to the discretion of the designer or can be teacher assigned. Use the sheets provided to sketch and draw your design ideas. Be creative in your thinking.



POSSIBLE SOLUTIONS

SKETCHES

PACKAGE ELEVATIONS


APPLIED CREATIVITY
APPLIED CREATIVITY
APPLIED
CREATIVITY
APPLIED CREATIVITY
APPLIED
CREATIVITY
APPLIED CREATIVITY
APPL
CREAT

WRAP AROUND BANDS

ONE ON EACH SIDE

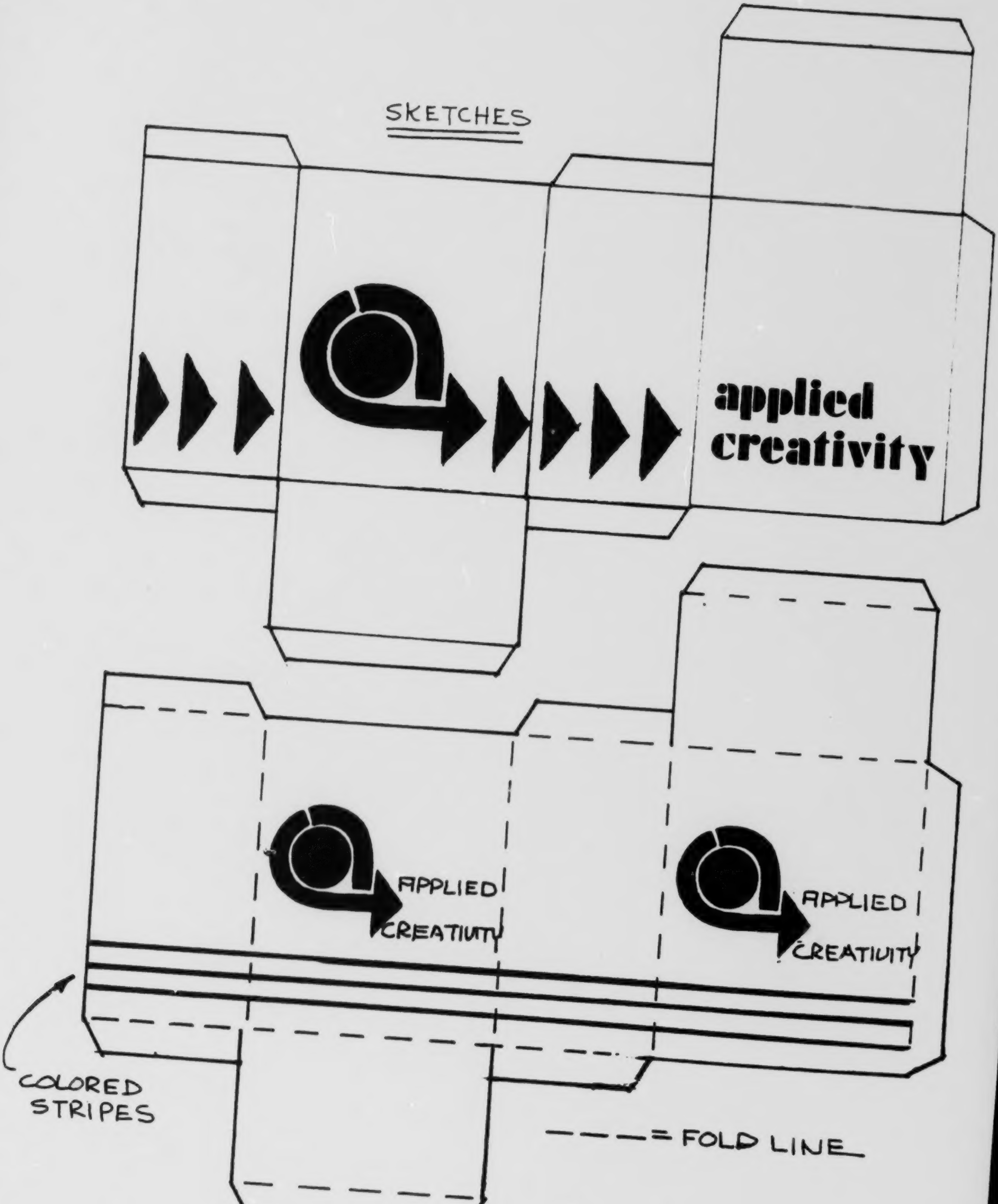
WRAP AROUND THE CORD

WRAP AROUND BAND

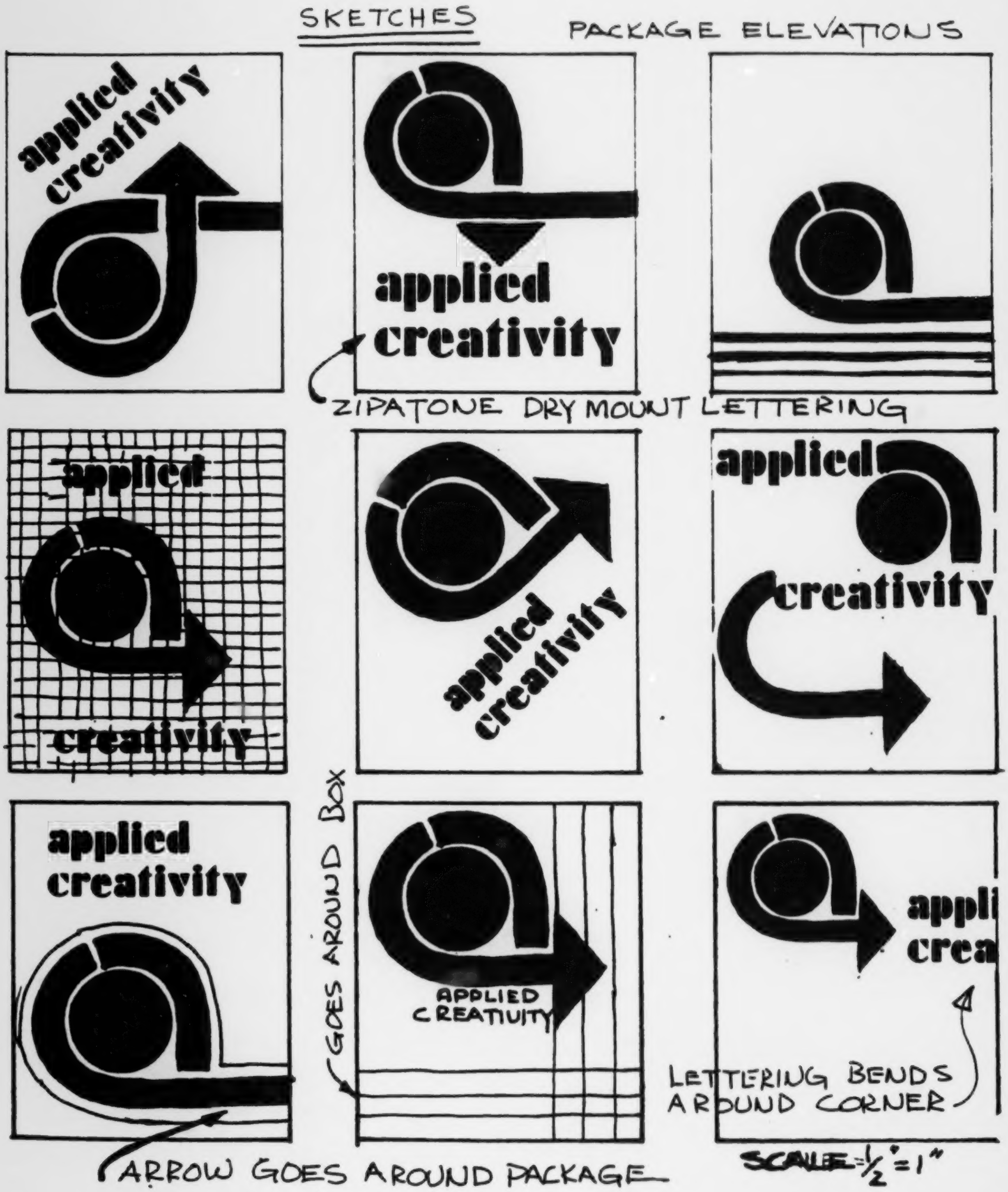
SCALE=1/2"=1"

POSSIBLE SOLUTIONS

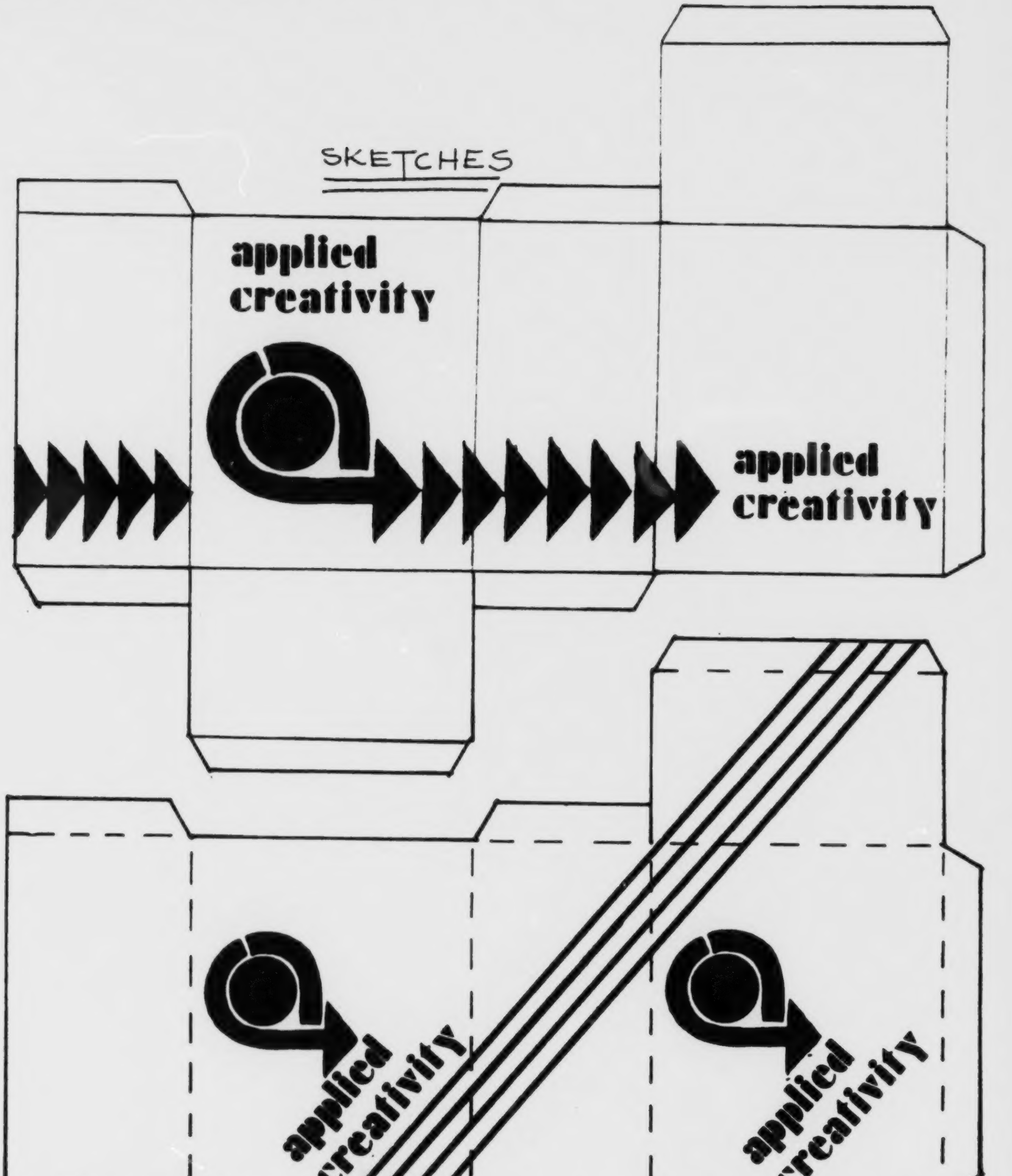
SKETCHES


applied
creativity
APPLIED
CREATIVITY
APPLIED
CREATIVITY
COLORED STRIPES
– – – = FOLD LINE

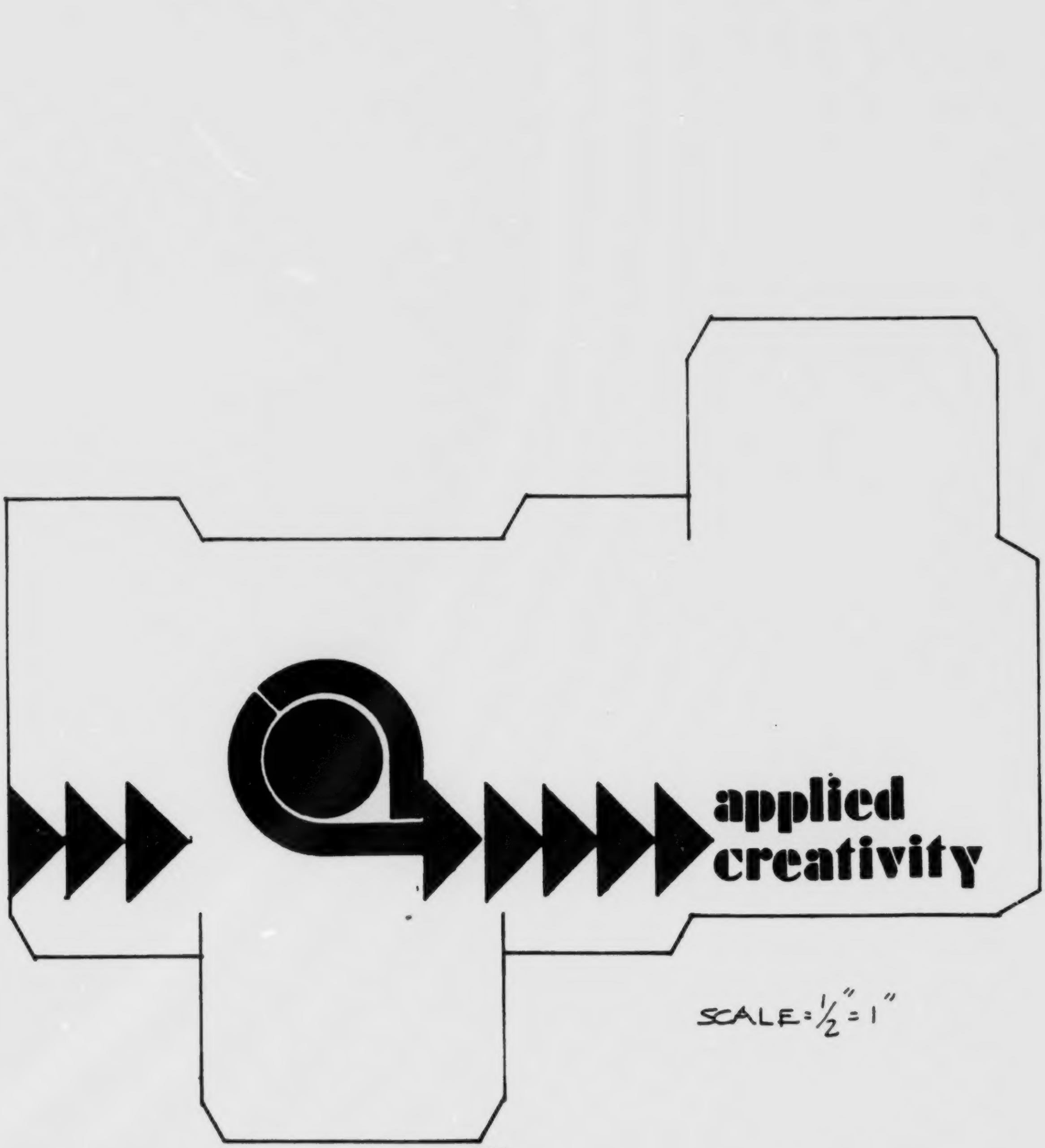
REFINED SOLUTIONS


SKETCHES
PACKAGE ELEVATIONS
applied creativity
applied creativity
ZIPATONE DRY MOUNT LETTERING
applied creativity
applied creativity
applied creativity
applied creativity
GOES AROUND BOX
APPLIED CREATIVITY
appli crea
LETTERING BENDS AROUND CORNER
ARROW GOES AROUND PACKAGE
SCALE = 1/2" = 1"

REFINED SOLUTIONS


SKETCHES
applied creativity
applied creativity
applied creativity
applied creativity
– – – – = FOLD LINE
COLORED STRIPES

FINAL SOLUTION


applied
creativity

SCALE = 1/2" = 1"

APPENDIX S

SAMPLE COPYRIGHT FORM

FORM VA

UNITED STATES COPYRIGHT OFFICE
LIBRARY OF CONGRESS
WASHINGTON, D.C. 20559

APPLICATION FOR COPYRIGHT REGISTRATION *for a Work of the Visual Arts*

HOW TO APPLY FOR COPYRIGHT REGISTRATION:

- ***First:*** Read the information on this page to make sure Form VA is the correct application for your work.
- ***Second:*** Open out the form by pulling this page to the left. Read through the detailed instructions before starting to complete the form.
- ***Third:*** Complete spaces 1-4 of the application, then turn the entire form over and, after reading the instructions for spaces 5-9, complete the rest of your application. Use typewriter or print in dark ink. Be sure to sign the form at space 8.
- ***Fourth:*** Detach your completed application from these instructions and send it with the necessary deposit of the work (see below) to: Register of Copyrights, Library of Congress, Washington, D.C. 20559. Unless you have a Deposit Account in the Copyright Office, your application and deposit must be accompanied by a check or money order for $10, payable to: *Register of Copyrights.*

WHEN TO USE FORM VA: Form VA is the appropriate form to use for copyright registration covering works of the visual arts. Both published and unpublished works can be registered on Form VA.

WHAT IS A "WORK OF THE VISUAL ARTS"? This category consists of "pictorial, graphic, or sculptural works," including two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproductions, maps, globes, charts, technical drawings, diagrams, and models.

WHAT DOES COPYRIGHT PROTECT? Copyright in a work of the visual arts protects those pictorial, graphic, or sculptural elements that, either alone or in combination, represent an "original work of authorship." The statute declares: "In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."

WORKS OF ARTISTIC CRAFTSMANSHIP AND DESIGNS: "Works of artistic craftsmanship" are registrable on Form VA, but the statute makes clear that protection extends to "their form" and not to "their mechanical or utilitarian aspects." The "design of a useful article" is considered copyrightable "only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article."

LABELS AND ADVERTISEMENTS: Works prepared for use in connection with the sale or advertisement of goods and services are registrable if they contain "original work of authorship." Use Form VA if the copyrightable material in the work you are registering is mainly pictorial or graphic; use Form TX if it consists mainly of text. *NOTE:* Words and short phrases such as names, titles, and slogans cannot be protected by copyright, and the same is true of standard symbols, emblems, and other commonly-used graphic designs that are in the public domain. When used commercially, material of that sort can sometimes be protected under State laws of unfair competition or under the Federal trademark laws. For information about trademark registration, write to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DEPOSIT TO ACCOMPANY APPLICATION: An application for copyright registration must be accompanied by a deposit representing the entire work for which registration is to be made. The following are the general deposit requirements for works of the visual arts, as set forth in the statute:

Unpublished work: Deposit one complete copy.

Published work: Deposit two complete copies of the best edition.

Work first published outside the United States: Deposit one complete copy of the first foreign edition.

Contribution to a collective work: Deposit one complete copy of the best edition of the collective work.

These general deposit requirements will vary in particular situations. In most cases, where the copies in which the work has been reproduced are three-dimensional, the Copyright Office Regulations provide for the deposit of identifying material (such as photographs or drawings) meeting certain requirements. For further information about the deposit requirements for works of the visual arts, see the reverse side of this sheet. For general information about copyright deposit, write to the Copyright Office.

DURATION OF COPYRIGHT: For works that were created after the effective date of the new statute (January 1, 1978), the basic copyright term will be the life of the author and fifty years after the author's death. For works made for hire, and for certain anonymous and pseudonymous works, the duration of copyright will be 75 years from publication or 100 years from creation, whichever is shorter. These same terms of copyright will generally apply to works that had been created before 1978 but had not been published or copyrighted before that date. For further information about the duration of copyright, including the terms of copyrights already in existence before 1978, write for Circular R15a.

PRIVACY ACT ADVISORY STATEMENT

Required by the Privacy Act of 1974 (Public Law 93-579)

AUTHORITY FOR REQUESTING THIS INFORMATION
- Title 17 USC Secs 409 and 410

FURNISHING THE REQUESTED INFORMATION IS
- Voluntary

BUT IF THE INFORMATION IS NOT FURNISHED
- It may be necessary to delay or refuse registration
- You may not be entitled to certain relief remedies and benefits provided in chapters 4 and 5 of title 17 USC

PRINCIPAL USES OF REQUESTED INFORMATION
- Establishment and maintenance of a public record
- Examination of the application for compliance with legal requirements

OTHER ROUTINE USES
- Public inspection and copying
- Preparation of public indexes
- Preparation of public catalogs of copyright registrations
- Preparation of search reports upon request

NOTE
- No other advisory statement will be given you in connection with this application
- Please retain this statement and refer to it if we communicate with you regarding this application

INSTRUCTIONS FOR SPACES 5-9

SPACE 5: PREVIOUS REGISTRATION

- ***General Instructions:*** The questions in space 5 are intended to find out whether an earlier registration has been made for this work and, if so, whether there is any basis for a new registration. As a general rule, only one basic copyright registration can be made for the same version of a particular work.
- ***Same Version:*** If this version is substantially the same as the work covered by a previous registration, a second registration is not generally possible unless (1) the work has been registered in unpublished form and a second registration is now being sought to cover the first published edition, or (2) someone other than the author is identified as copyright claimant in the earlier registration and the author is now seeking registration in his or her own name. If either of these two exceptions apply, check the appropriate box and give the earlier registration number and date. Otherwise, do not submit Form VA; instead, write the Copyright Office for information about supplementary registration or recordation of transfer of copyright ownership.
- ***Changed Version:*** If the work has been changed, and you are now seeking registration to cover the additions or revisions, check the third box in space 5, give the earlier registration number and date, and complete both parts of space 6.
- ***Previous Registration Number and Date:*** If more than one previous registration has been made for the work, give the number and date of the latest registration.

SPACE 6: COMPILATION OR DERIVATIVE WORK

- ***General Instructions:*** Complete both parts of space 6 if this work is a "compilation," or "derivative work," or both, and if it is based on or incorporates one or more "preexisting works" that are not eligible for registration for one reason or another: works that have already been published or registered, or works that have fallen into the public domain. A "compilation" is defined as "a work formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship." A "derivative work" is "a work based on one or more preexisting works." In addition to various forms in which works may be "recast, transformed, or adapted," derivative works include works "consisting of editorial revisions, annotations, elaborations, or other modifications" if these changes, as a whole, represent an original work of authorship.

- ***Preexisting Material:*** If the work is a compilation, give a brief, general statement describing the nature of the material that has been compiled. Example: "Compilation of 19th Century political cartoons". In the case of a derivative work, identify the preexisting work that has been recast, transformed, or adapted. Examples: "Grünewald Altarpiece"; "19th Century quilt design."

- ***Material Added to this Work:*** The statute requires a "brief, general statement of the additional material covered by the copyright claim being registered." This statement should describe all of the material in this particular version of the work that: (1) represents an original work of authorship; (2) has not fallen into public domain; (3) has not been previously published; and (4) has not been previously registered for copyright in unpublished form. Examples: "Adaptation of design and additional artistic work"; "Reproduction of painting by photolithography"; "Additional cartographic material"; "Compilation of photographs."

SPACES 7, 8, 9: FEE, CORRESPONDENCE, CERTIFICATION, RETURN ADDRESS

- ***Deposit Account and Mailing Instructions (Space 7):*** If you maintain a Deposit Account in the Copyright Office, identify it in space 7. Otherwise you will need to send the registration fee of $10 with your application. The space headed "Correspondence" should contain the name and address of the person to be consulted if correspondence about this application becomes necessary.
- ***Certification (Space 8):*** The application is not acceptable unless it bears the handwritten signature of the author or other copyright claimant, or of the owner of exclusive right(s), or of the duly authorized agent of such author, claimant, or owner.
- ***Address for Return of Certificate (Space 9):*** The address box must be completed legibly, since the certificate will be returned in a window envelope.

MORE INFORMATION

THE COPYRIGHT NOTICE: For published works, the law provides that a copyright notice in a specified form "shall be placed on all publicly distributed copies from which the work can be visually perceived." Use of the copyright notice is the responsibility of the copyright owner, and does not require advance permission from the Copyright Office.

- ***Form of the Notice:*** The required form of the notice for copies generally consists of three elements: (1) the symbol "©", or the word "Copyright", or the abbreviation "Copr."; (2) the year of first publication; and (3) the name of the owner of copyright in the work, or an abbreviation by which the name can be recognized, or a generally known alternative designation of the owner. Example: "© 1978 Samuel Marlove." Under the statute, the year date may be omitted from the notice in cases "where a pictorial, graphic, or sculptural work, with accompanying text matter, if any, is reproduced in or on greeting cards, postcards, stationery, jewelry, dolls, toys, or any useful articles."

- ***Position of the Notice:*** The notice is to be affixed to the copies "in such manner and location as to give reasonable notice of the claim of copyright."

- ***Errors or Omissions:*** Unlike the law in effect before 1978, the new copyright statute provides procedures for correcting errors in the copyright notice, and even for curing the omission of the notice. However, a failure to comply with the notice requirements may still result in the loss of some copyright protection and, unless corrected within five years, the complete loss of copyright. For further information about the copyright notice and the procedures for correcting errors or omissions, write to the Copyright Office.

FORM OF DEPOSIT FOR WORKS OF THE VISUAL ARTS

Exceptions to General Deposit Requirements: As explained on the reverse side of this page, the statutory deposit requirements (generally one copy for unpublished works and two copies for published works) will vary for particular kinds of works of the visual arts. The copyright law authorizes the Register of Copyrights to issue regulations specifying "the administrative classes into which works are to be placed for purposes of deposit and registration, and the nature of the copies or phonorecords to be deposited in the various classes specified." For particular classes, the regulations may require or permit "the deposit of identifying material instead of copies or phonorecords," or "the deposit of only one copy or phonorecord where two would normally be required."

What Should You Deposit? The detailed requirements with respect to the kind of deposit to accompany an application on Form VA are contained in the Copyright Office Regulations. The following does not cover all of the deposit requirements, but is intended to give you some general guidance.

- For an unpublished work, the material deposited should represent the entire copyrightable content of the work for which registration is being sought;

- For a published work, the material deposited should generally consist of two complete copies of the best edition. Exceptions:

—For certain types of works, one complete copy may be deposited instead of two. These include greeting cards, postcards, stationery, labels, advertisements, scientific drawings, and globes.

—For most three-dimensional sculptural works, and for certain two-dimensional works, the Copyright Office Regulations require the deposit of identifying material (photographs or drawings in a specified form) rather than copies.

—Under certain circumstances, for works published in five copies or less or in limited, numbered editions, the deposit may consist of one copy or of identifying reproductions.

22.1 -006

FORM VA

UNITED STATES COPYRIGHT OFFICE

REGISTRATION NUMBER

VA VAU

EFFECTIVE DATE OF REGISTRATION

. . . .
(Month) (Day) (Year)

DO NOT WRITE ABOVE THIS LINE. IF YOU NEED MORE SPACE, USE CONTINUATION SHEET (FORM VA/CON)

① Title

TITLE OF THIS WORK:

Previous or Alternative Titles

NATURE OF THIS WORK: (See instructions)

PUBLICATION AS A CONTRIBUTION: (If this work was published as a contribution to a periodical, serial, or collection, give information about the collective work in which the contribution appeared.)

Title of Collective Work . . . . Vol. . . . . No . . . . Date . . . . Pages . . . .

② Author(s)

IMPORTANT: Under the law, the "author" of a "work made for hire" is generally the employer, not the employee (see instructions). If any part of this work was "made for hire," check "Yes" in the space provided, give the employer (or other person for whom the work was prepared) as "Author" of that part, and leave the space for dates blank.

1

NAME OF AUTHOR:

Was this author's contribution to the work a "work made for hire"? Yes . . . . . No . . . . .

DATES OF BIRTH AND DEATH:
Born (Year) Died (Year)

AUTHOR'S NATIONALITY OR DOMICILE:
Citizen of . . . . (Name of Country) } or { Domiciled in . . . . (Name of Country)

AUTHOR OF: (Briefly describe nature of this author's contribution)

WAS THIS AUTHOR'S CONTRIBUTION TO THE WORK:
Anonymous? Yes No
Pseudonymous? Yes No

If the answer to either of these questions is "Yes," see detailed instructions attached

2

NAME OF AUTHOR:

Was this author's contribution to the work a "work made for hire"? Yes . . . . . No . . . . .

DATES OF BIRTH AND DEATH:
Born (Year) Died (Year)

AUTHOR'S NATIONALITY OR DOMICILE:
Citizen of . . . . (Name of Country) } or { Domiciled in . . . . (Name of Country)

AUTHOR OF: (Briefly describe nature of this author's contribution)

WAS THIS AUTHOR'S CONTRIBUTION TO THE WORK:
Anonymous? Yes No
Pseudonymous? Yes No

If the answer to either of these questions is "Yes," see detailed instructions attached

3

NAME OF AUTHOR:

Was this author's contribution to the work a "work made for hire"? Yes . . . . . No . . . . .

DATES OF BIRTH AND DEATH:
Born (Year) Died (Year)

AUTHOR'S NATIONALITY OR DOMICILE:
Citizen of . . . . (Name of Country) } or { Domiciled in . . . . (Name of Country)

AUTHOR OF: (Briefly describe nature of this author's contribution)

WAS THIS AUTHOR'S CONTRIBUTION TO THE WORK:
Anonymous? Yes No
Pseudonymous? Yes No

If the answer to either of these questions is "Yes," see detailed instructions attached

③ Creation and Publication

YEAR IN WHICH CREATION OF THIS WORK WAS COMPLETED:

Year . . . .

(This information must be given in all cases.)

DATE AND NATION OF FIRST PUBLICATION:

Date . . . .
(Month) (Day) (Year)

Nation . . . .
(Name of Country)

(Complete this block ONLY if this work has been published.)

④ Claimant(s)

NAME(S) AND ADDRESS(ES) OF COPYRIGHT CLAIMANT(S):

TRANSFER: (If the copyright claimant(s) named here in space 4 is different from the author(s) named in space 2, give a brief statement of how the claimant(s) obtained ownership of the copyright.)

- *Complete all applicable spaces (numbers 5-9) on the reverse side of this page*
- *Follow detailed instructions attached*
- *Sign the form at line 8*

DO NOT WRITE HERE

Page 1 of . . . . pages

	EXAMINED BY CHECKED BY	APPLICATION RECEIVED	FOR COPYRIGHT OFFICE USE ONLY
	CORRESPONDENCE ☐ Yes	DEPOSIT RECEIVED	
	DEPOSIT ACCOUNT FUNDS USED ☐	REMITTANCE NUMBER AND DATE	

DO NOT WRITE ABOVE THIS LINE. IF YOU NEED ADDITIONAL SPACE, USE CONTINUATION SHEET (FORM VA/CON)

PREVIOUS REGISTRATION:

5 Previous Registration

- Has registration for this work, or for an earlier version of this work, already been made in the Copyright Office? Yes .... No ....
- If your answer is "Yes," why is another registration being sought? (Check appropriate box)
  - ☐ This is the first published edition of a work previously registered in unpublished form.
  - ☐ This is the first application submitted by this author as copyright claimant.
  - ☐ This is a changed version of the work, as shown by line 6 of the application.
- If your answer is "Yes," give: Previous Registration Number .... Year of Registration ....

COMPILATION OR DERIVATIVE WORK: (See instructions)

6 Compilation or Derivative Work

PREEXISTING MATERIAL: (Identify any preexisting work or works that this work is based on or incorporates.)

....

....

....

....

MATERIAL ADDED TO THIS WORK: (Give a brief, general statement of the material that has been added to this work and in which copyright is claimed.)

....

....

....

....

7 Fee and Correspondence

DEPOSIT ACCOUNT: (If the registration fee is to be charged to a Deposit Account established in the Copyright Office, give name and number of Account.)

Name: ....

Account Number: ....

CORRESPONDENCE: (Give name and address to which correspondence about this application should be sent.)

Name ....

Address .... (Apt.)

.... (City) (State) (ZIP)

CERTIFICATION: * I, the undersigned, hereby certify that I am the: (Check one)

☐ author ☐ other copyright claimant ☐ owner of exclusive right(s) ☐ authorized agent of .... (Name of author or other copyright claimant, or owner of exclusive right(s))

of the work identified in this application and that the statements made by me in this application are correct to the best of my knowledge.

8 Certification (Application must be signed)

Handwritten signature: (X) ....

Typed or printed name: .... Date ....

9 Address For Return of Certificate

.... (Name)

.... (Number, Street and Apartment Number)

.... (City) (State) (ZIP code)

MAIL CERTIFICATE TO

(Certificate will be mailed in window envelope)

* 17 U.S.C. § 506(e): FALSE REPRESENTATION—Any person who knowingly makes a false representation of a material fact in the application for copyright registration provided for by section 409, or in any written statement filed in connection with the application, shall be fined not more than $2,500.

226

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981—341-278/8

APPENDIX T

Design Problems

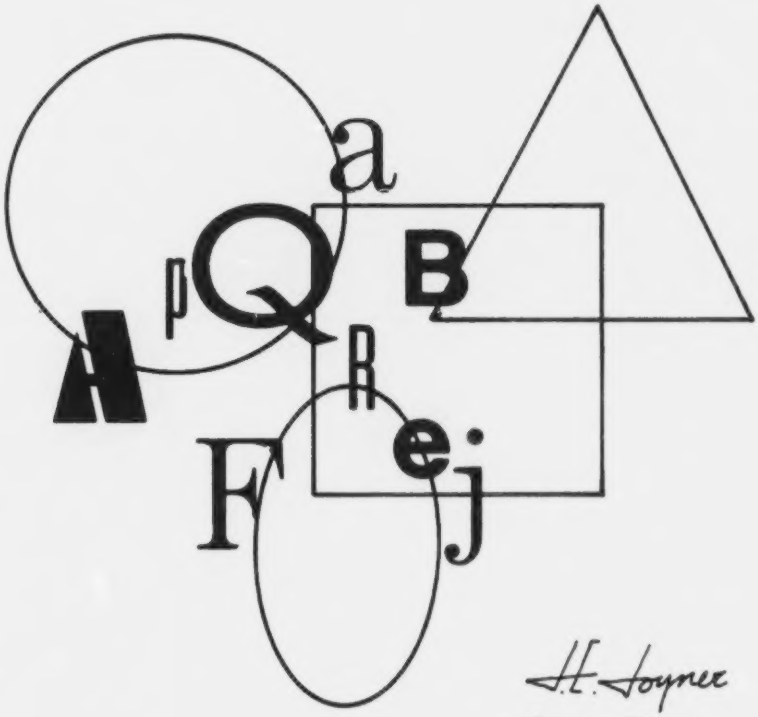
DESIGN

PROBLEM

Design your own personal logo or monogram. Use the sheets that are provided to sketch as many solutions as you can in the allotted time. Be creative in your thinking.

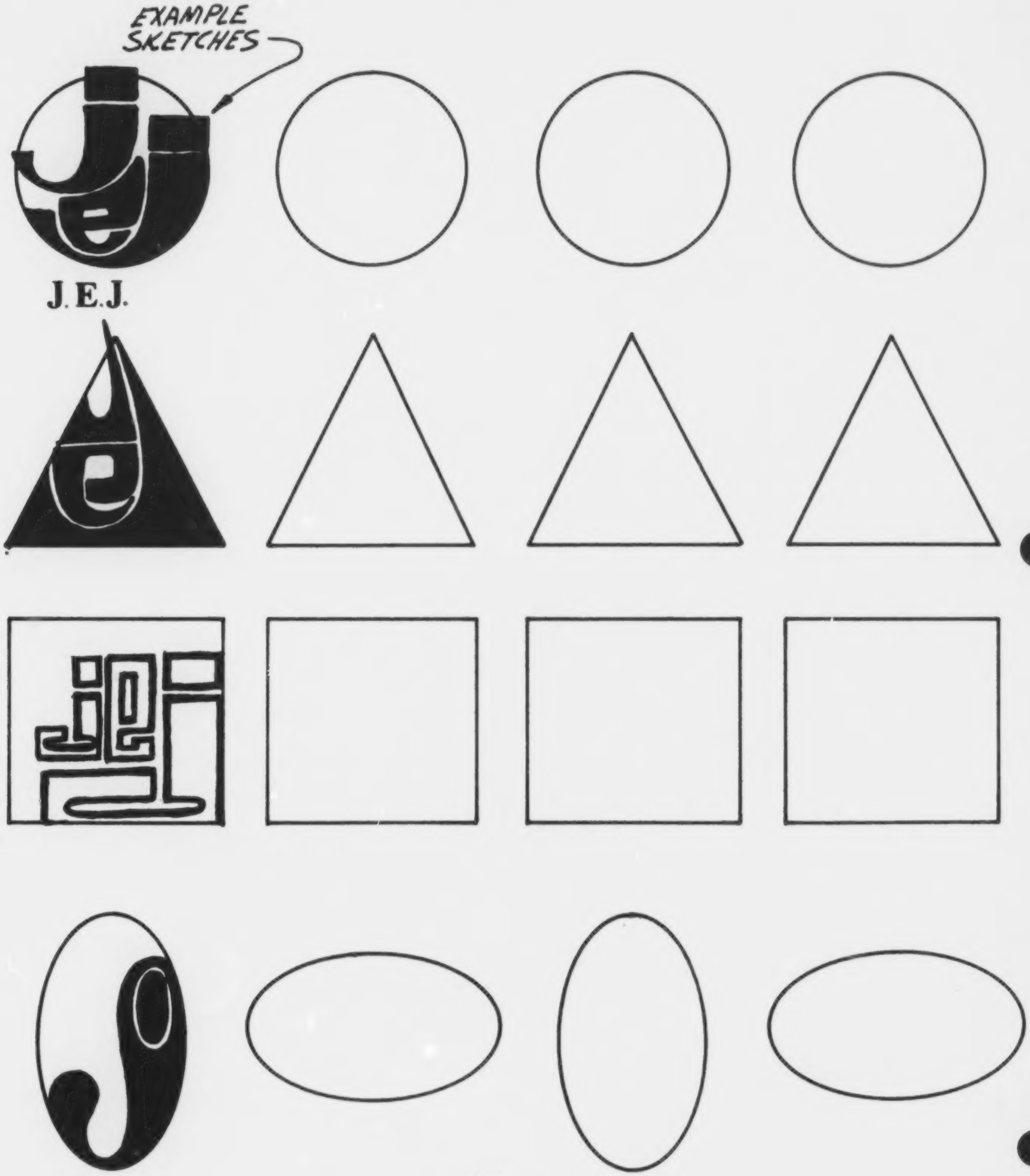
LIMITATIONS

Using the four basic shapes below as a guide, take your one or two initials and develop a design that could be printed on any of your possessions.

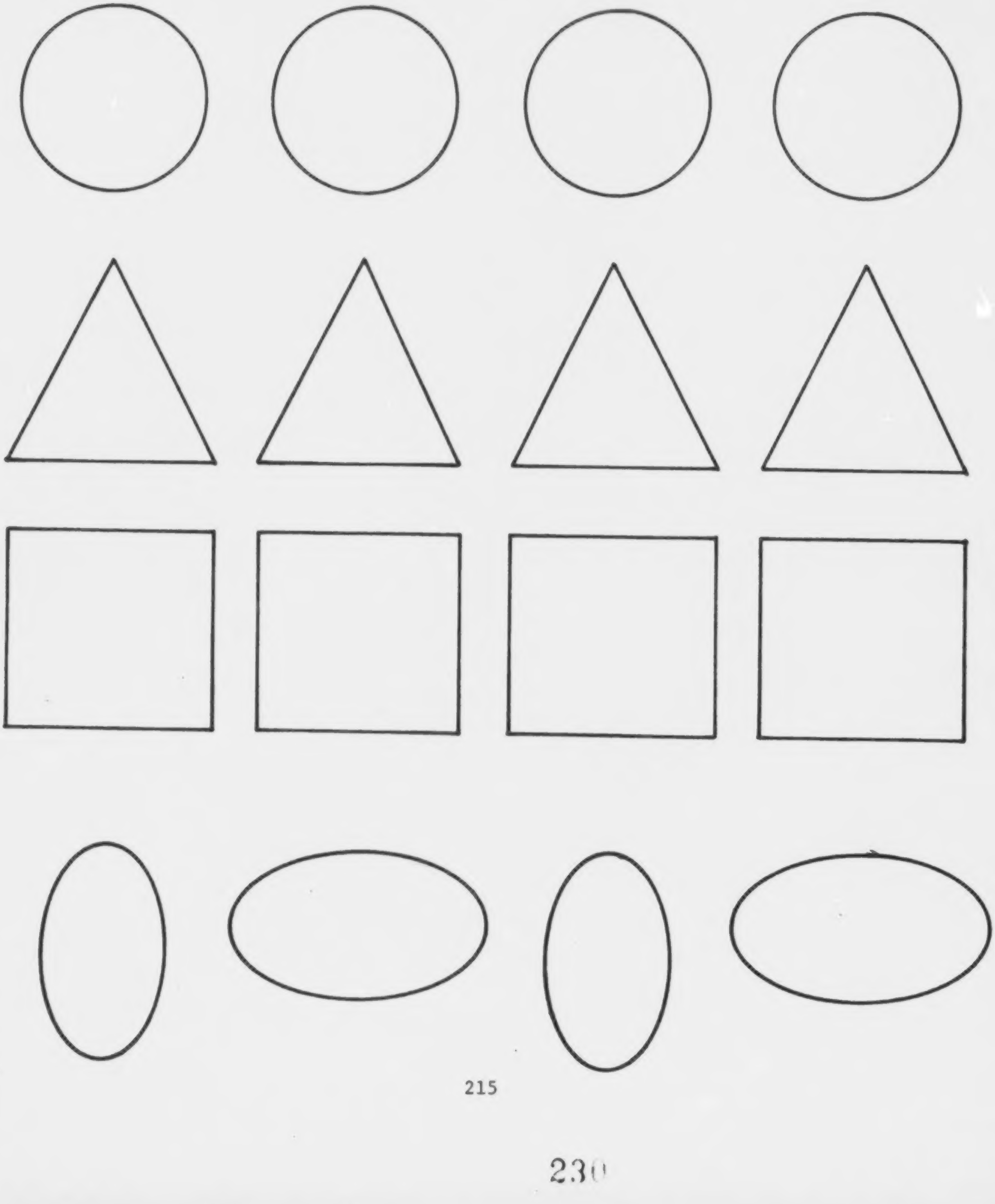


J.L. Joyner
4-7-72

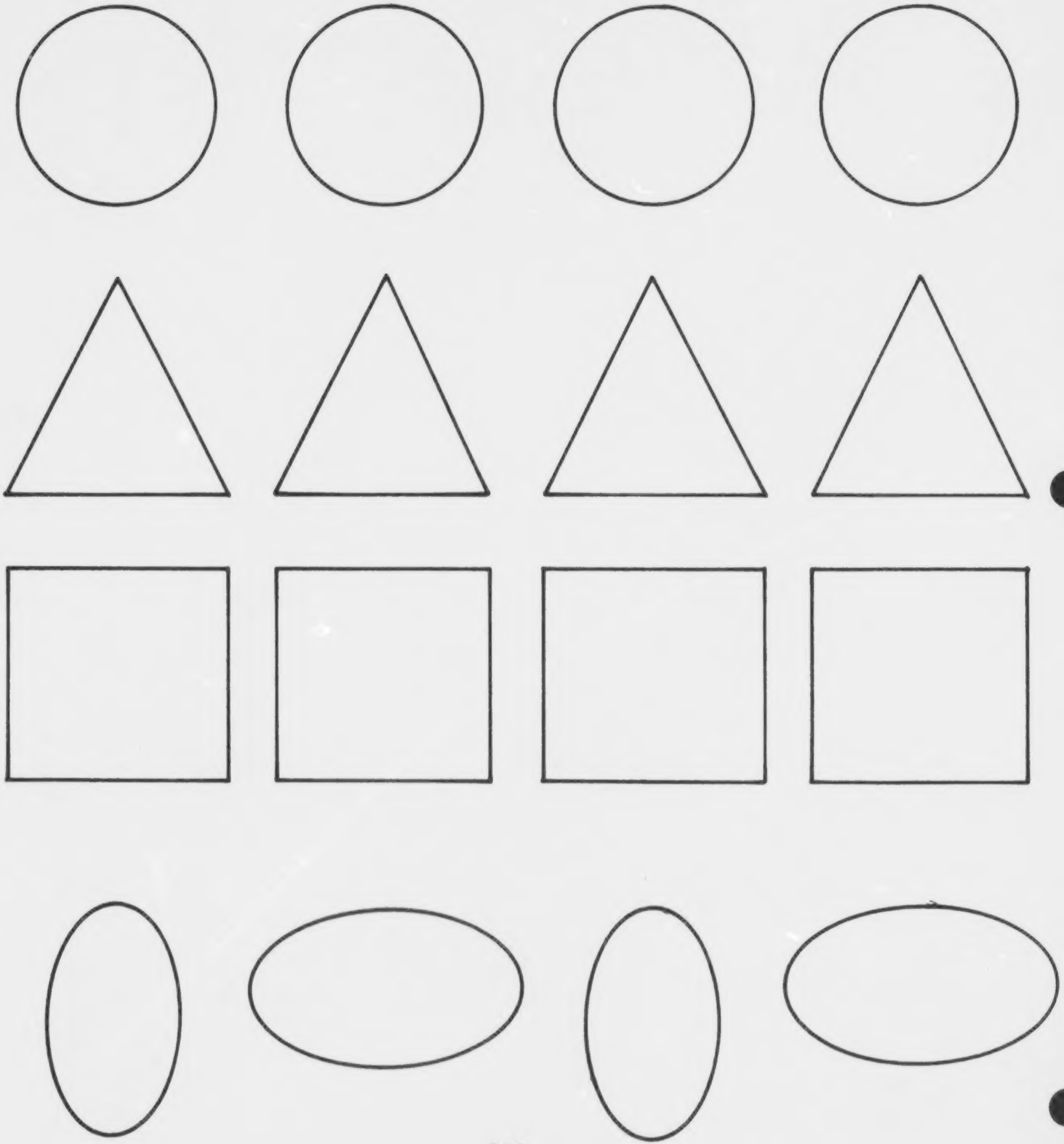
Possible solutions


EXAMPLE SKETCHES
J.E.J.

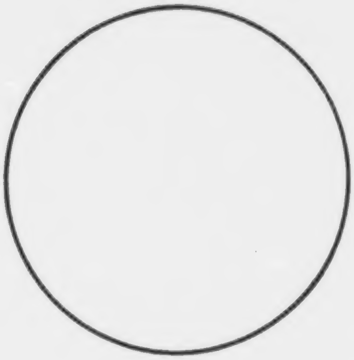
Possible solutions

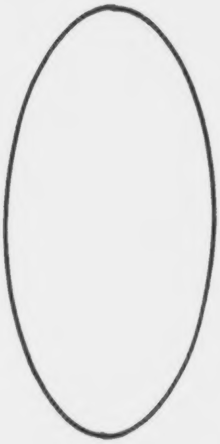


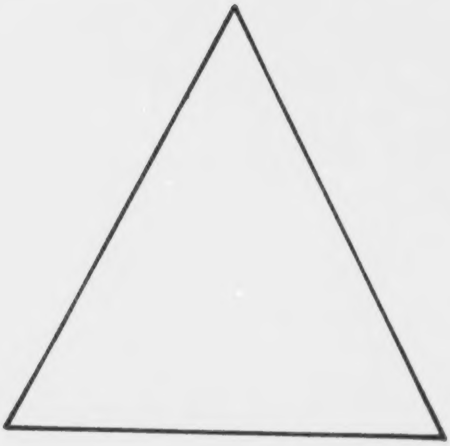
Refined Solutions

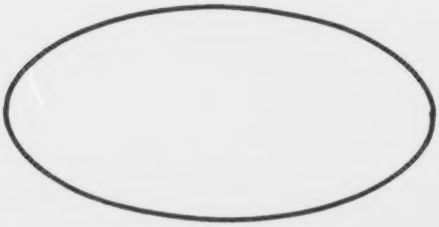


Final Solution









DESIGN

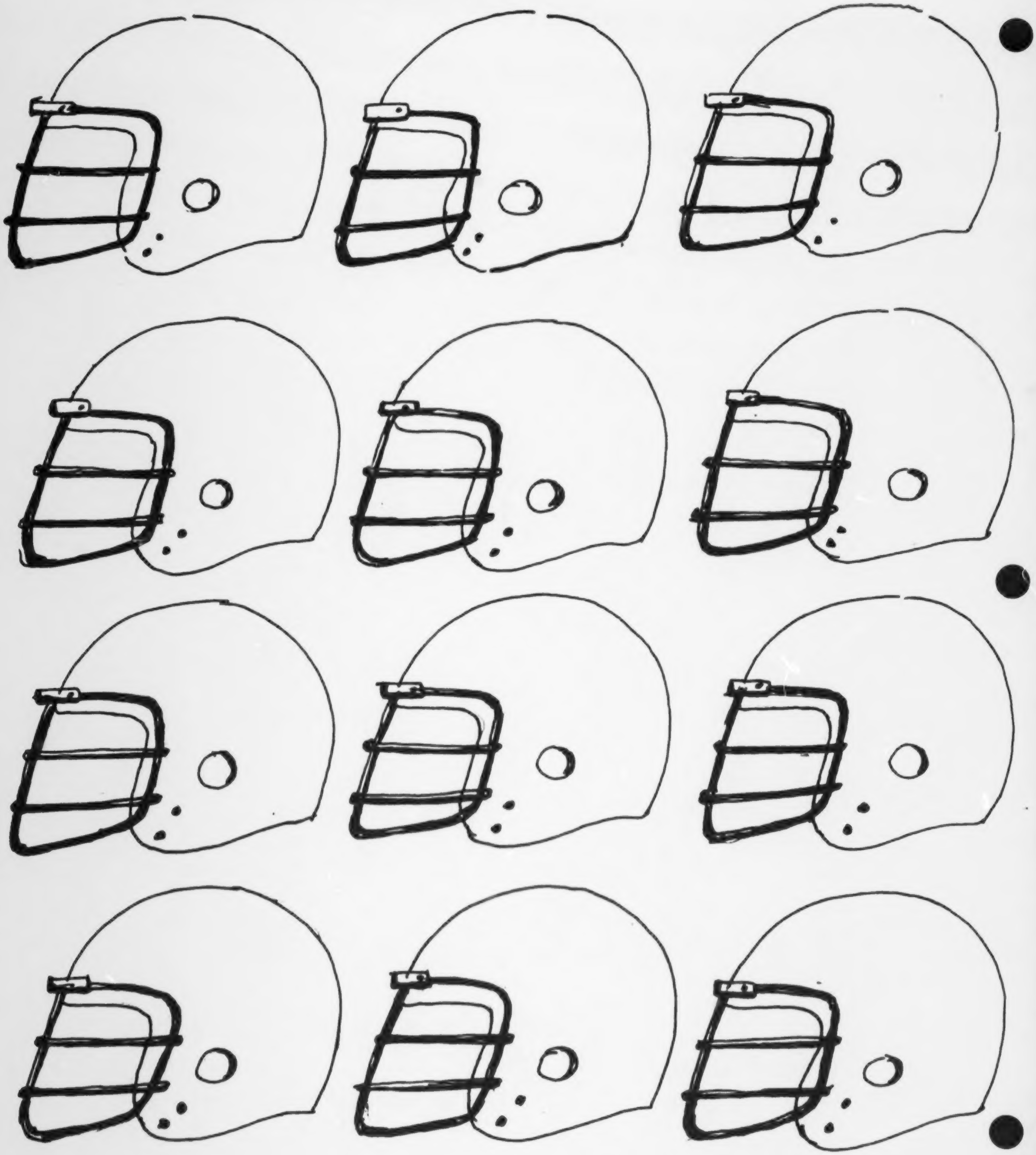
PROBLEM

You are a designer and the owner of a new NFL franchise has commissioned you to develop the name, mascot, and design the logo for this new football franchise. Use the sheets provided to sketch and draw your design ideas. Be creative in your thinking.

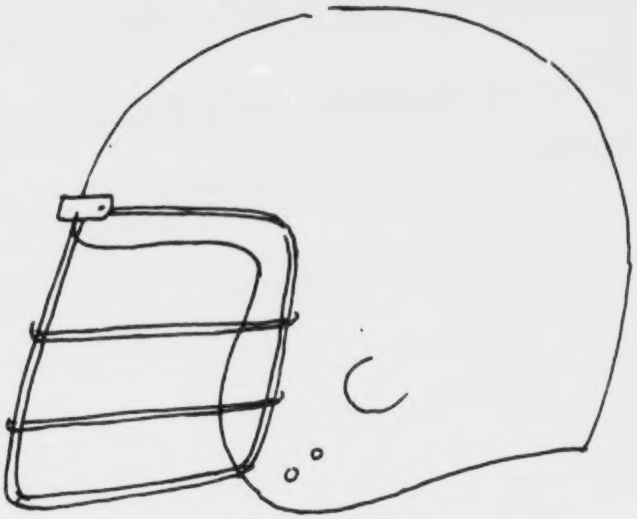
JOYNER 87

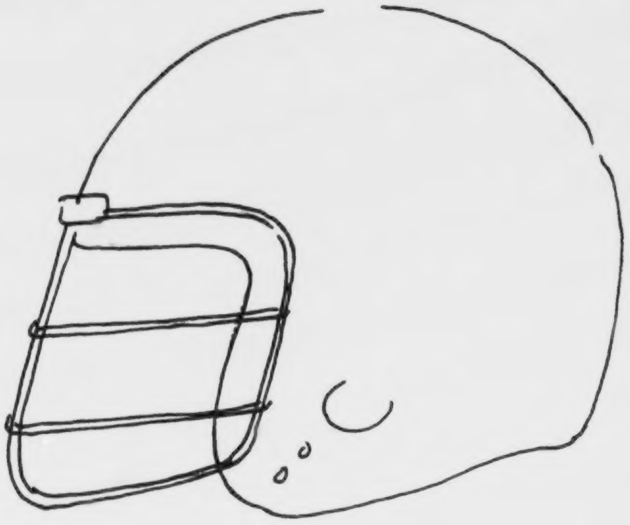
BEST COPY AVAILABLE

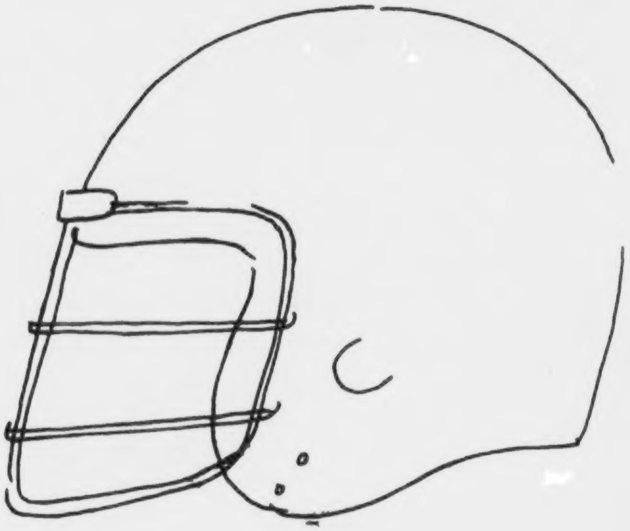
POSSIBLE SOLUTIONS

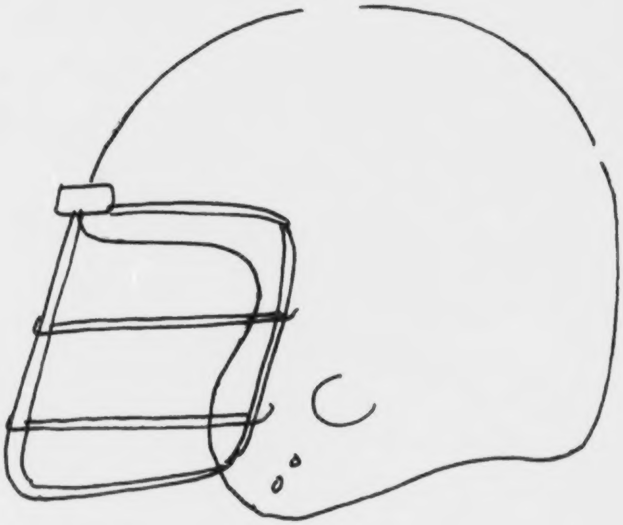


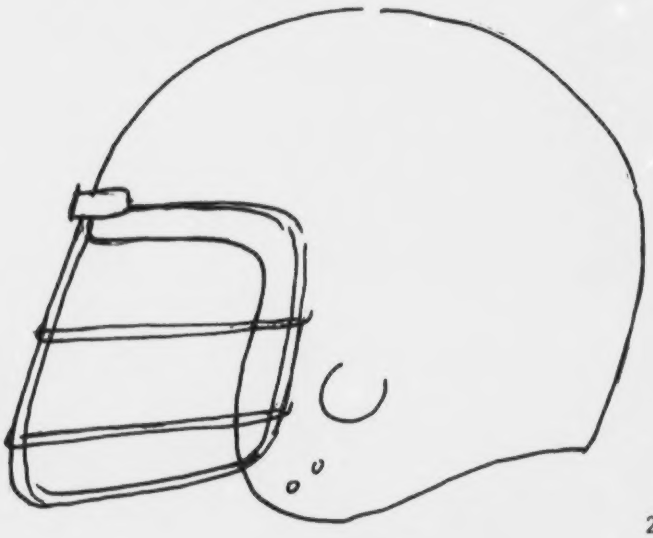
REFINED SOLUTIONS

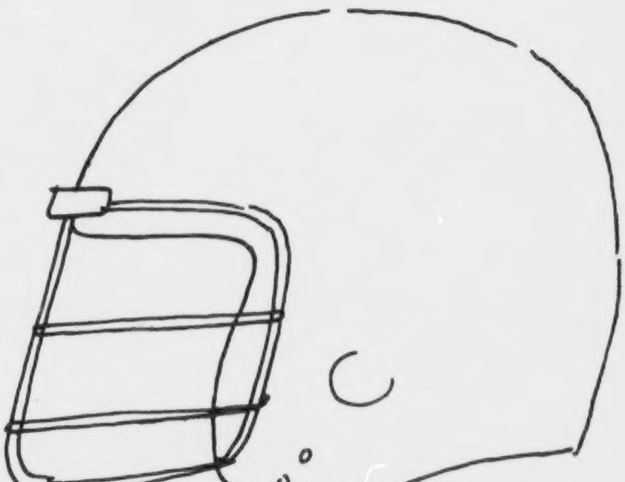




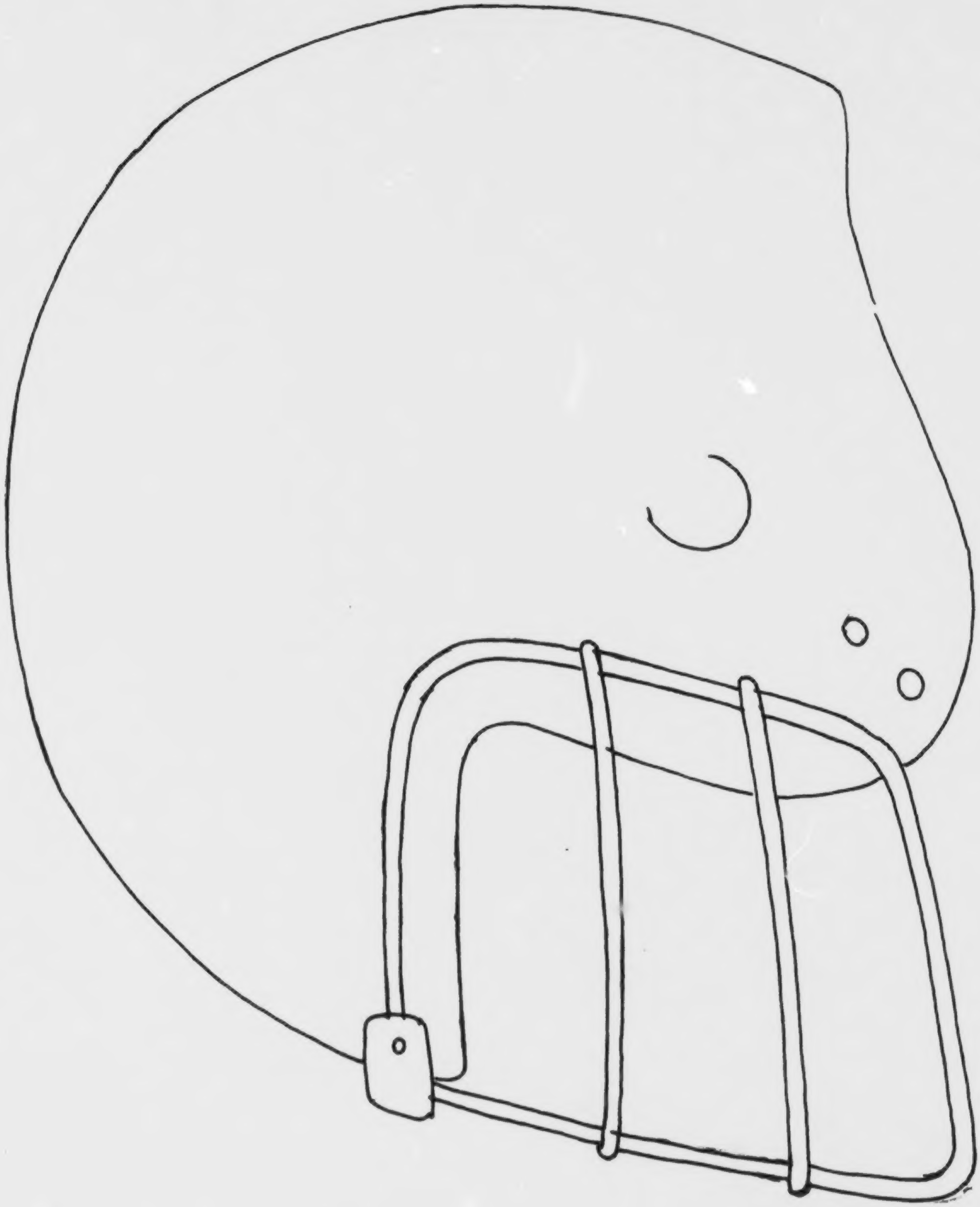








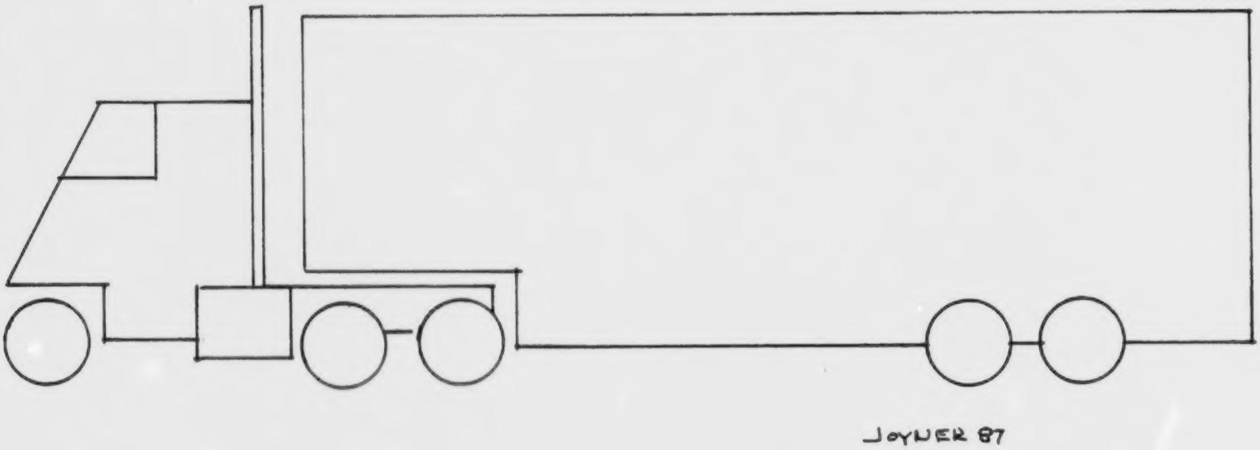
FINAL SOLUTION



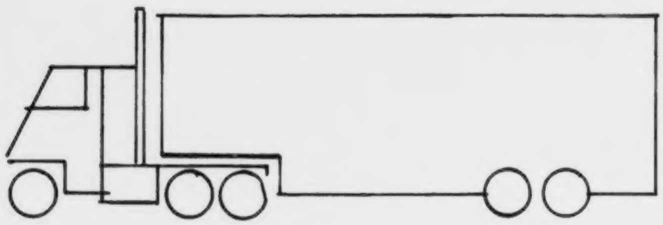
DESIGN

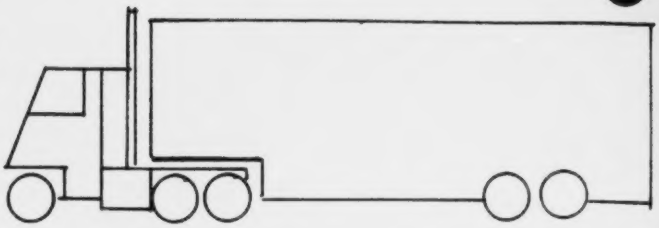
PROBLEM

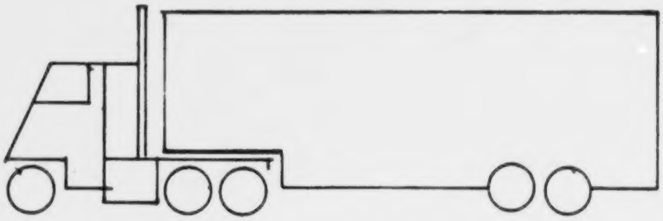
Develop a name and design the logo and graphics for a racing team. This logo and graphics will be used on the car and transport truck of that team. Use the sheets provided to sketch and draw your design ideas. Be creative in your thinking.

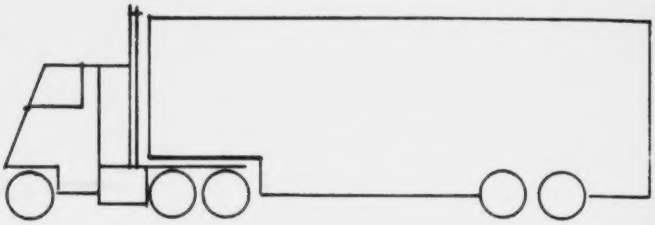


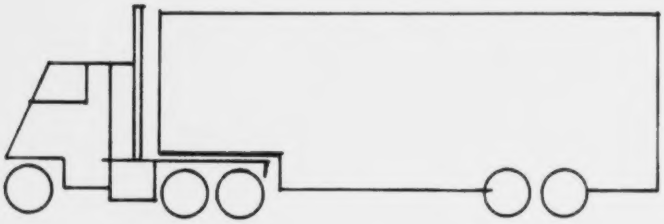
POSSIBLE SOLUTIONS

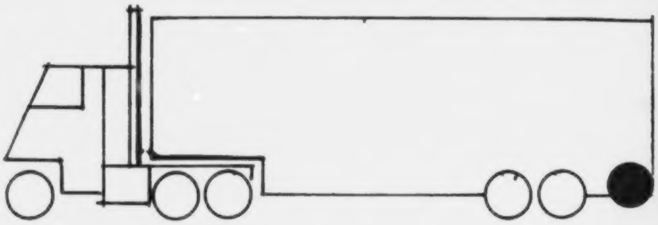


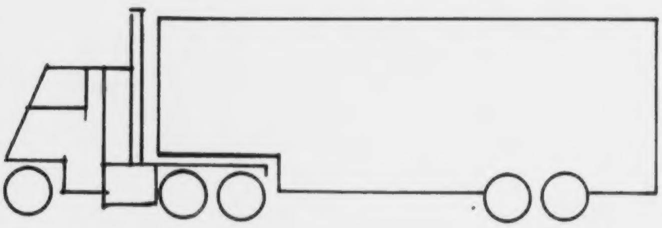


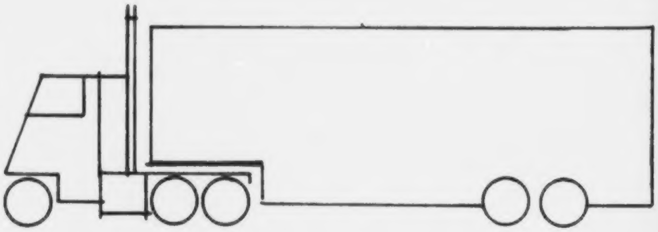


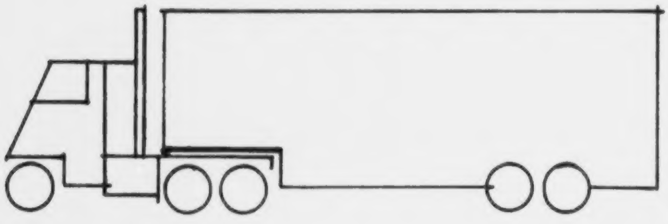


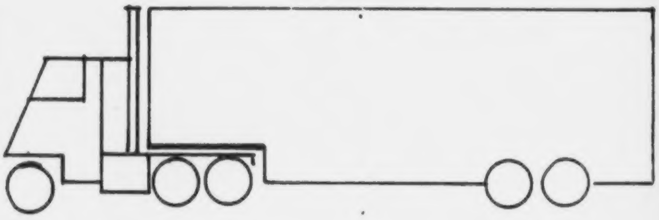


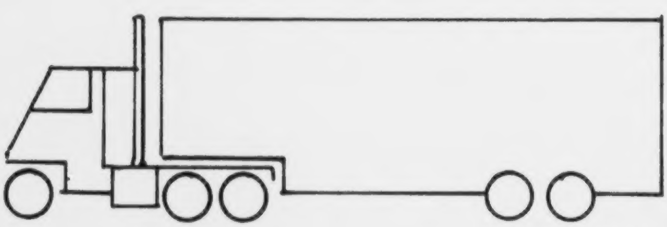


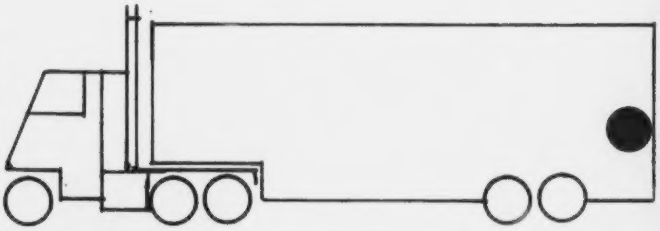




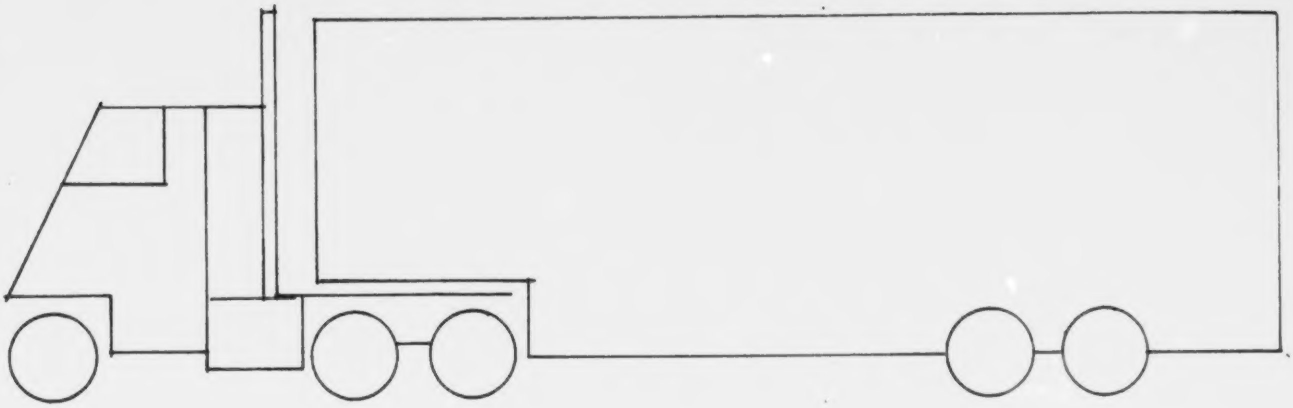


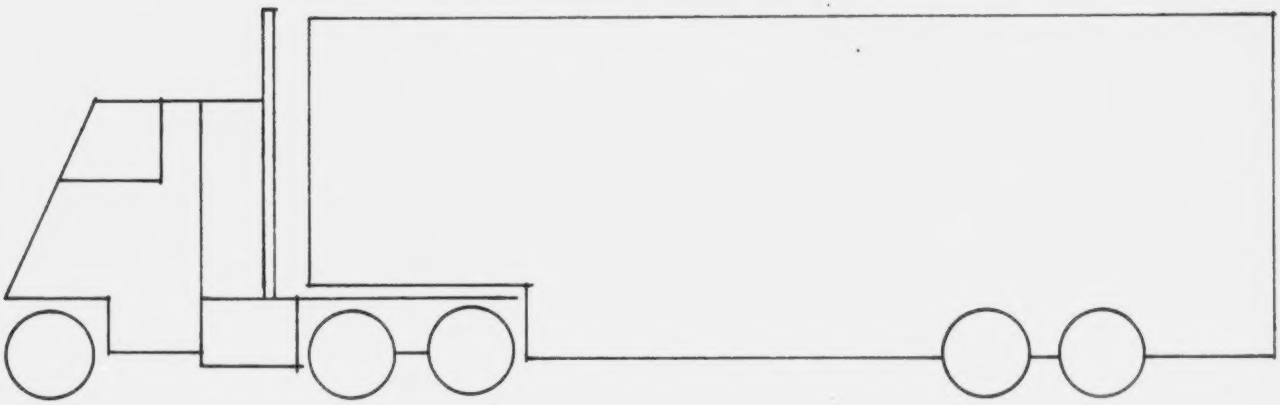


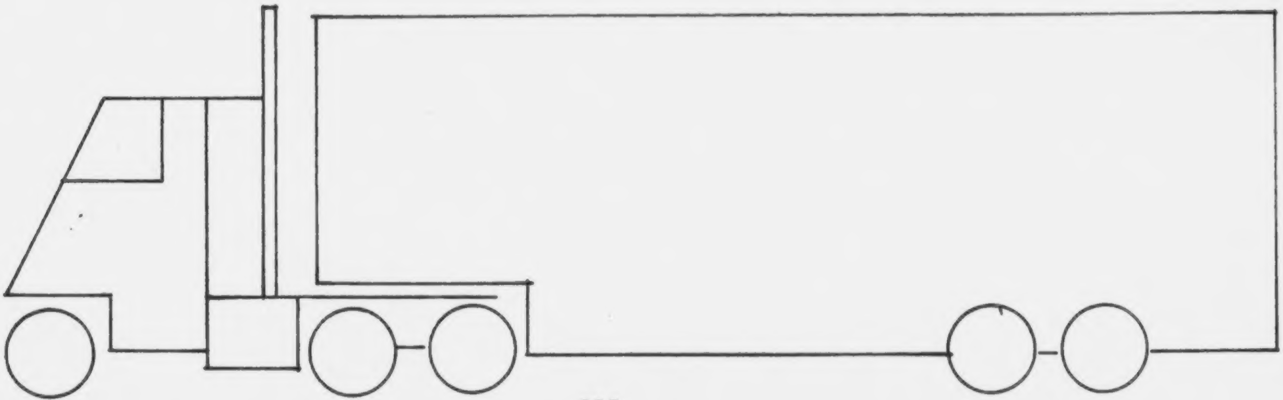




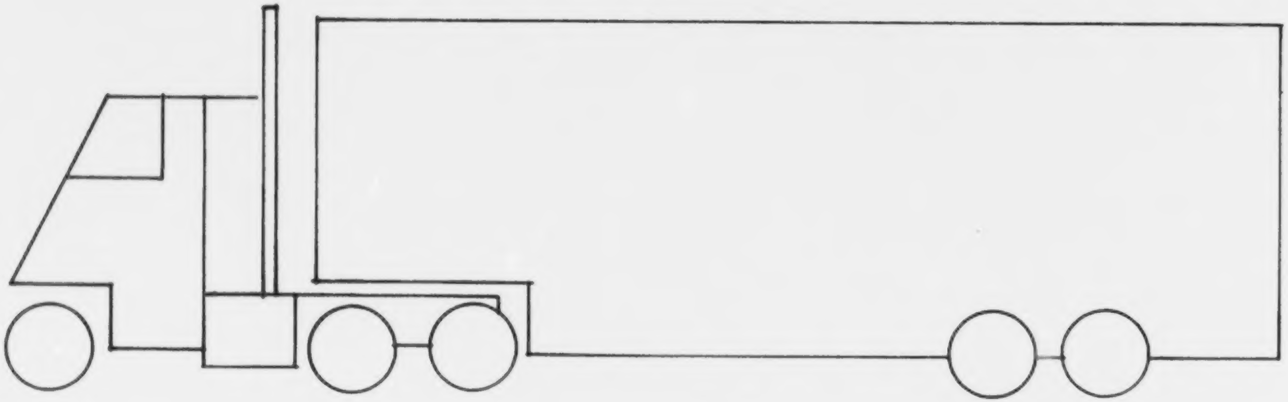
REFINED SOLUTIONS







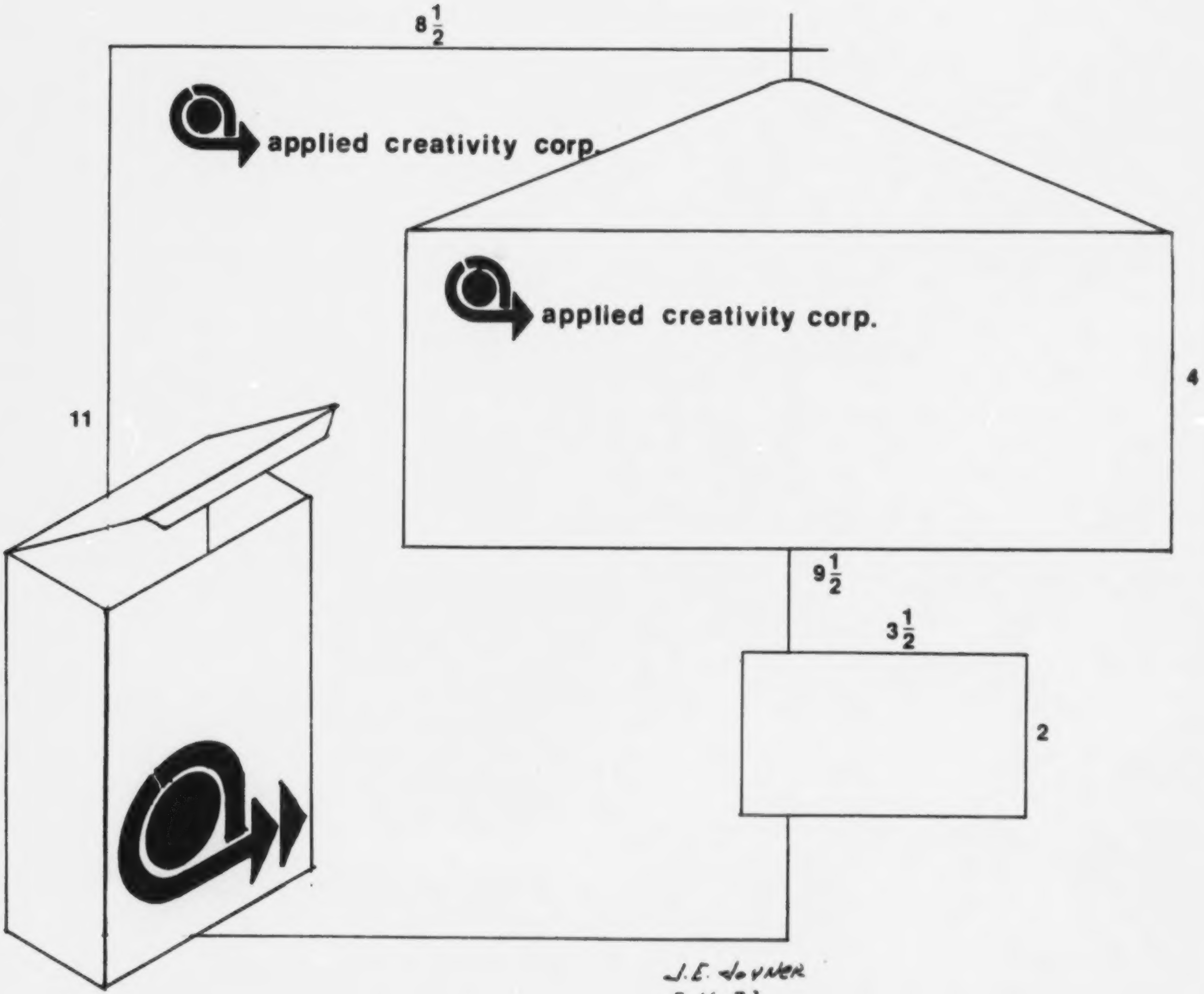
FINAL SOLUTION



DESIGN

PROBLEM

Design a logo (company symbol or trademark) for a particular company. This logo should be suitable for use on stationery, envelopes, publications, publicity materials and package design.


8 1/2
applied creativity corp.
applied creativity corp.
4
11
9 1/2
3 1/2
2

J.E. Joyner
5-11-73

POSSIBLE SOLUTIONS

REFINED SOLUTIONS

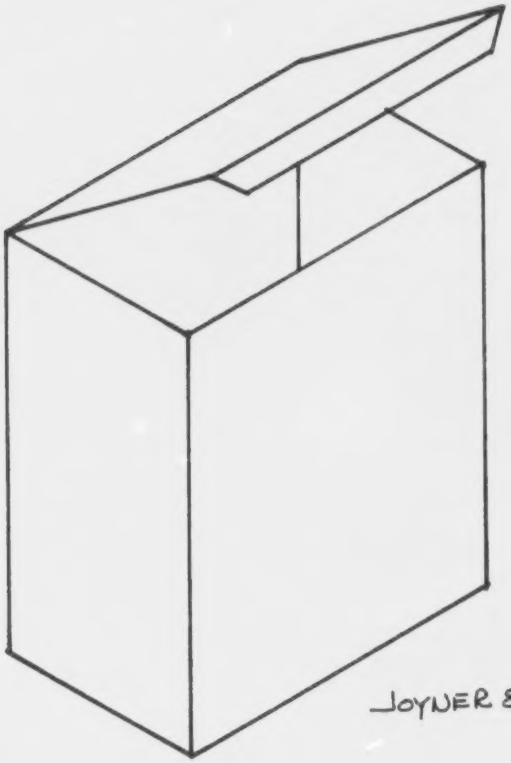
FINAL SOLUTION

245

DESIGN

PROBLEM

Design the package and the graphics for the package of a common consumer product. Incorporate the company name and logo into the graphics for the package. The type of product is left to the discretion of the designer or can be teacher assigned. Use the sheets provided to sketch and draw your design ideas. Be creative in your thinking.



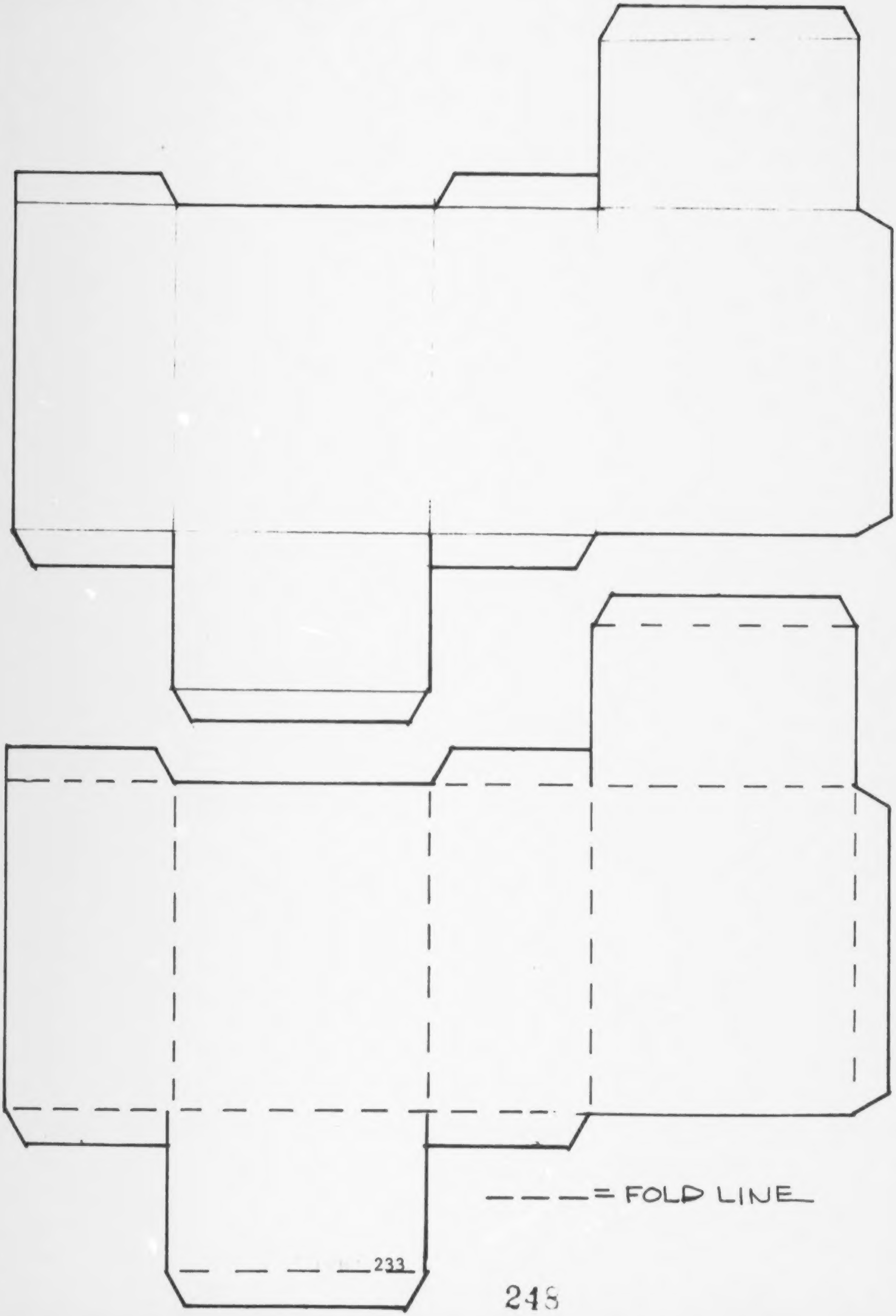
JOYNER 87

POSSIBLE SOLUTIONS

PACKAGE ELEVATIONS

SCALE $\frac{1}{2}$" = 1"

POSSIBLE SOLUTIONS

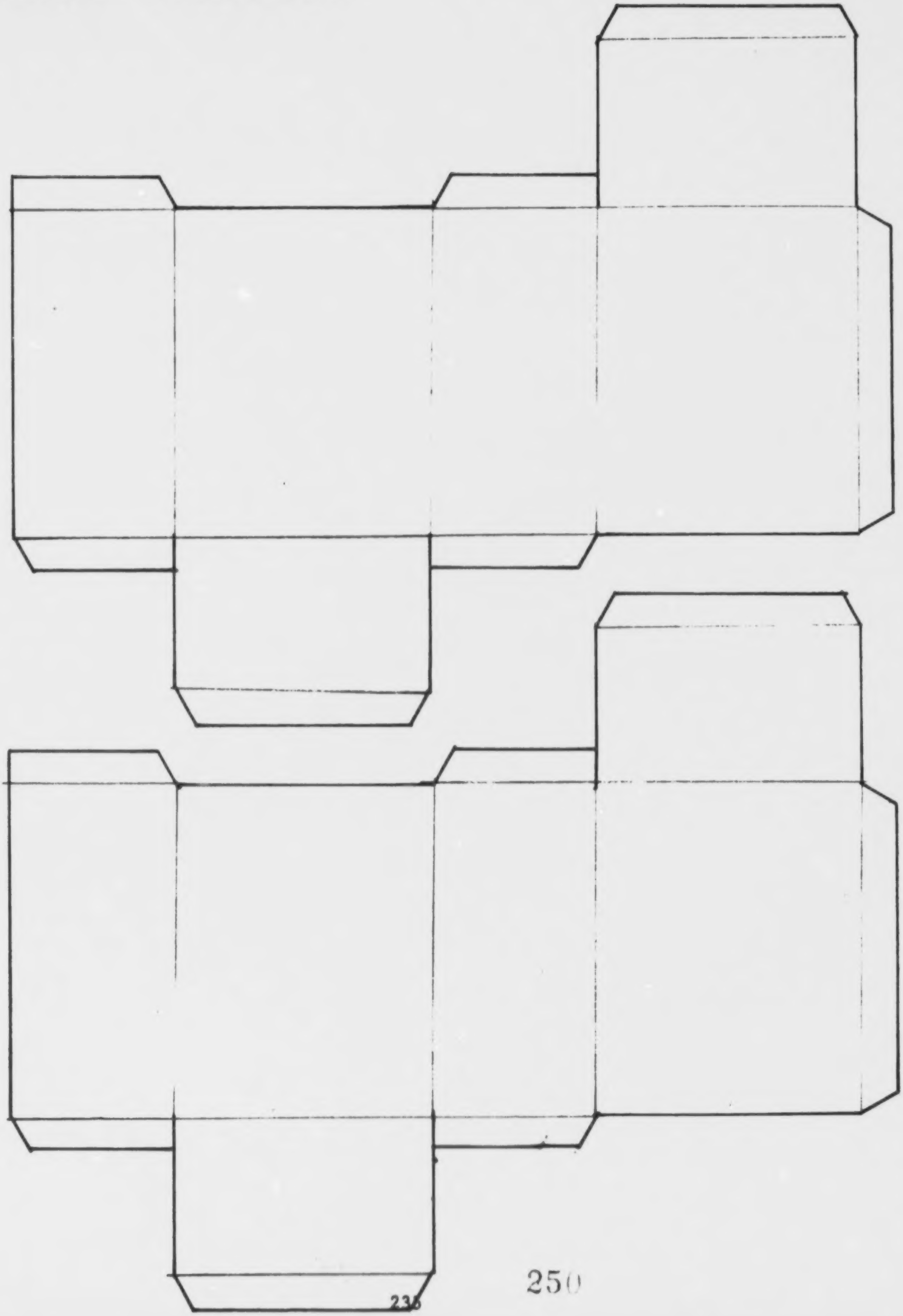


REFINED SOLUTIONS

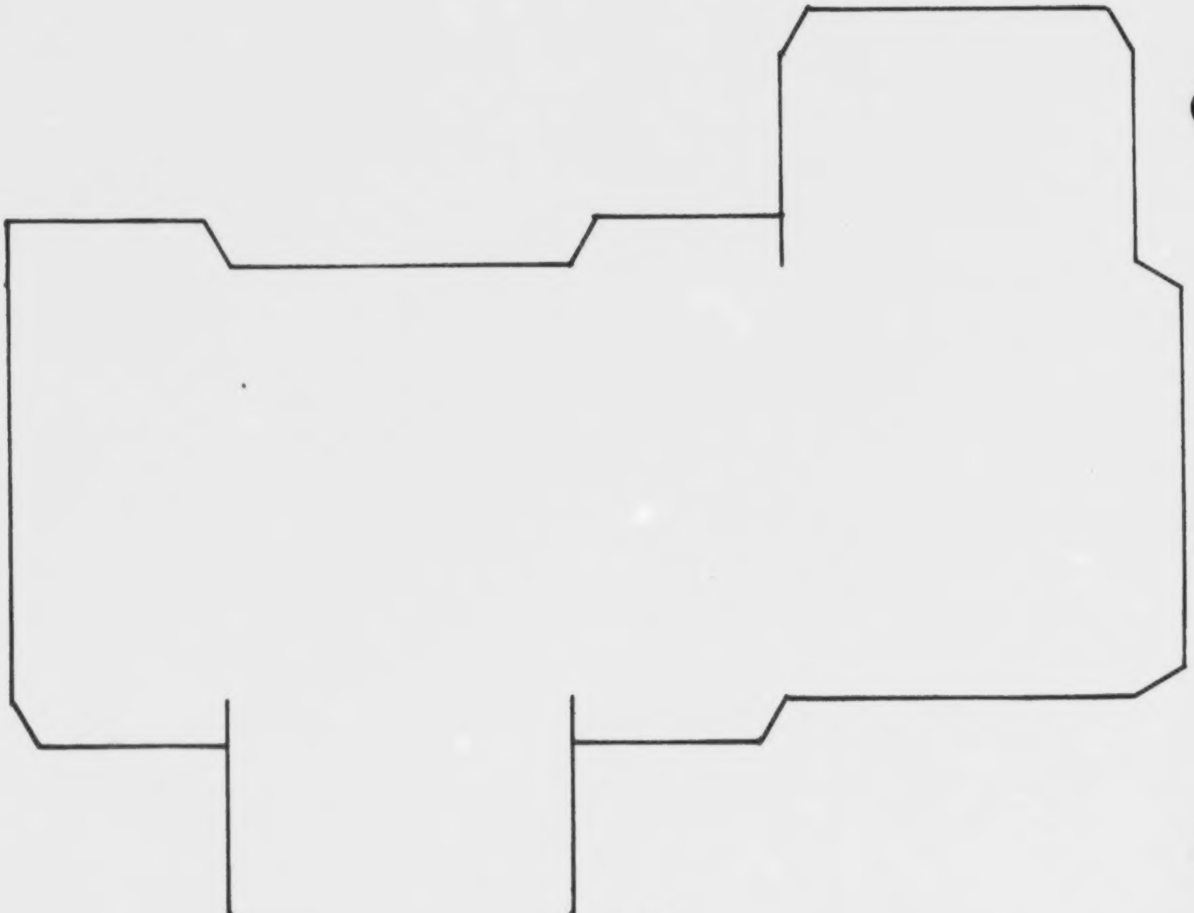
PACKAGE ELEVATIONS

SCALE $\frac{1}{2}'' = 1''$

REFINED SOLUTIONS



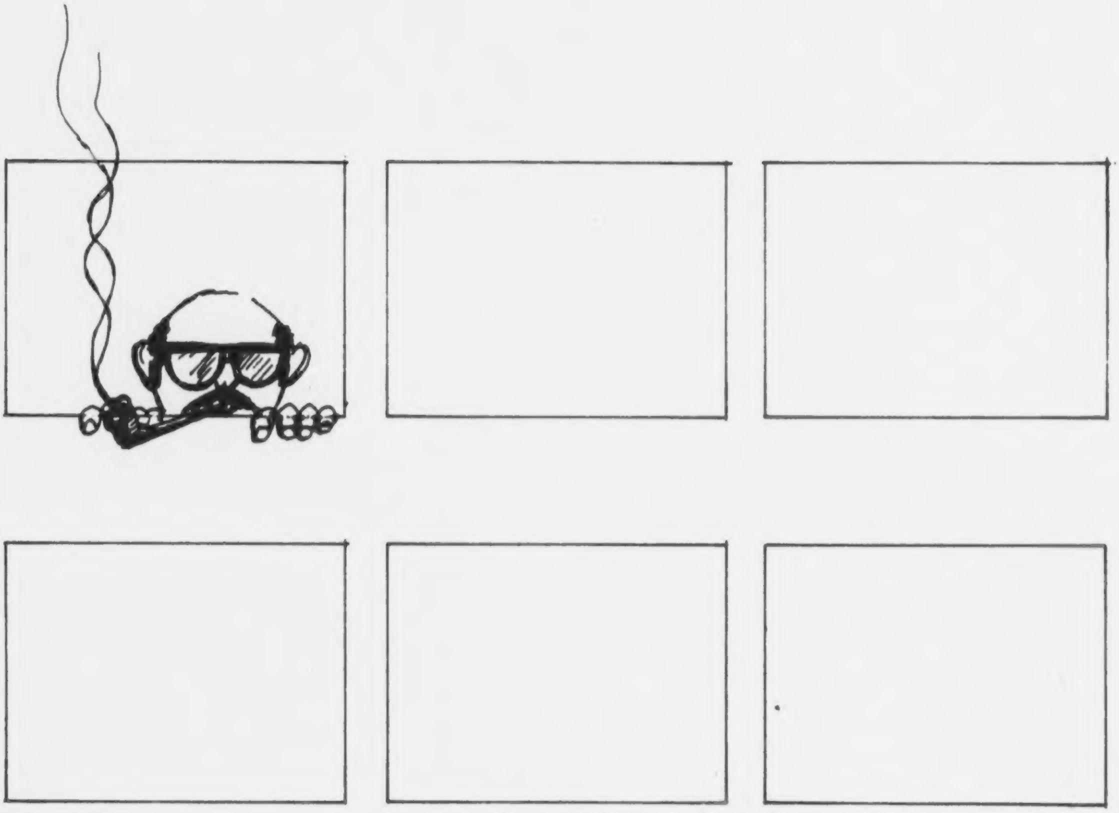
FINAL SOLUTION



DESIGN

PROBLEM

Develop a cartoon character and illustrate that character in a six-frame comic strip. This is known as a story board and is the kind seen in the newspapers each day. Draw the comic strip and write the script for what is said. Use the sheets provided to develop your creative ideas. Draw the final solution in ink and color pencil.



JOYNER 87

POSSIBLE SOLUTIONS

1.

2.

REFINED SOLUTIONS

1.

2.

FINAL SOLUTION

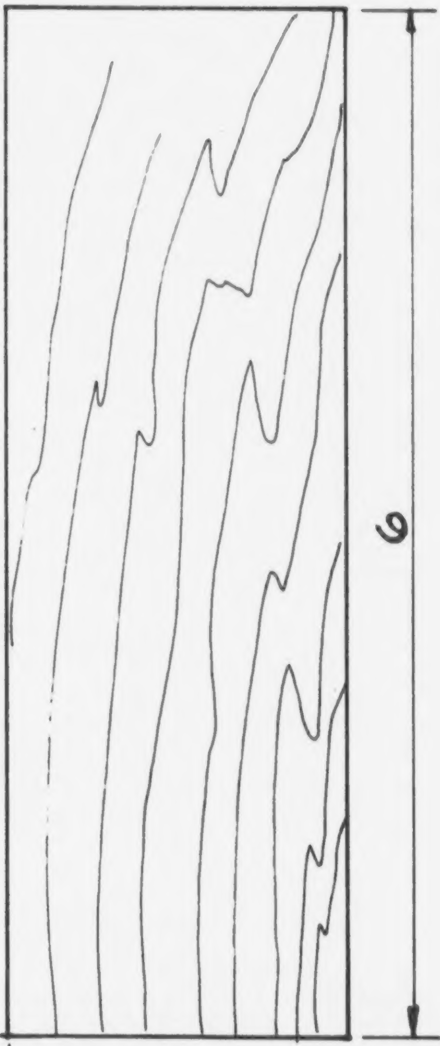
DESIGN

PROBLEM

Given two pieces of wood that are 2" X 2" X 6" in size, design the exterior form of a pair of candle holders.

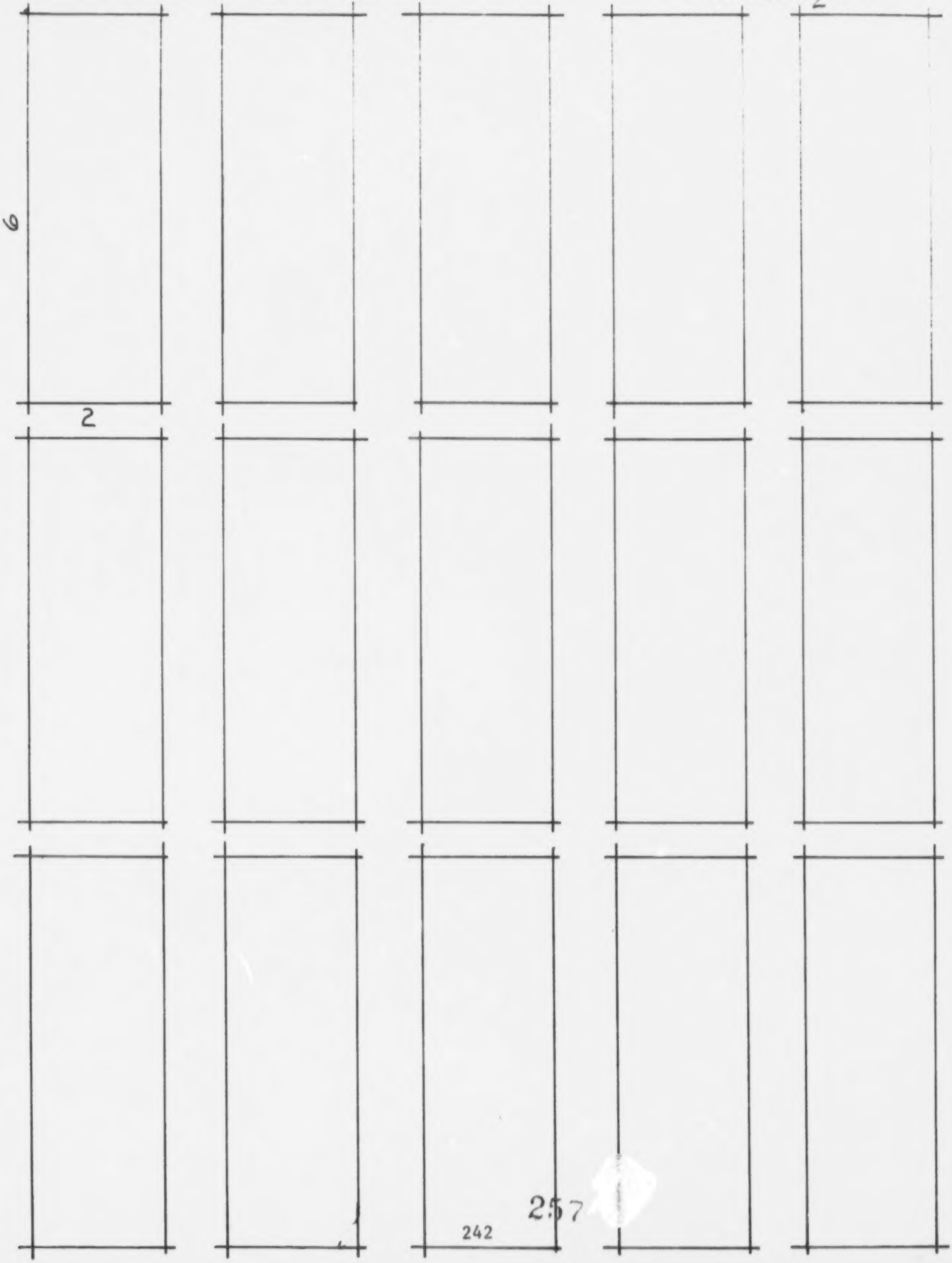
LIMITATIONS

The maximum size of the candle holder is 2" X 2" X 6". The final design would be turned in the wood lathe and a standard ½" diameter candle will be used.



POSSIBLE SOLUTIONS

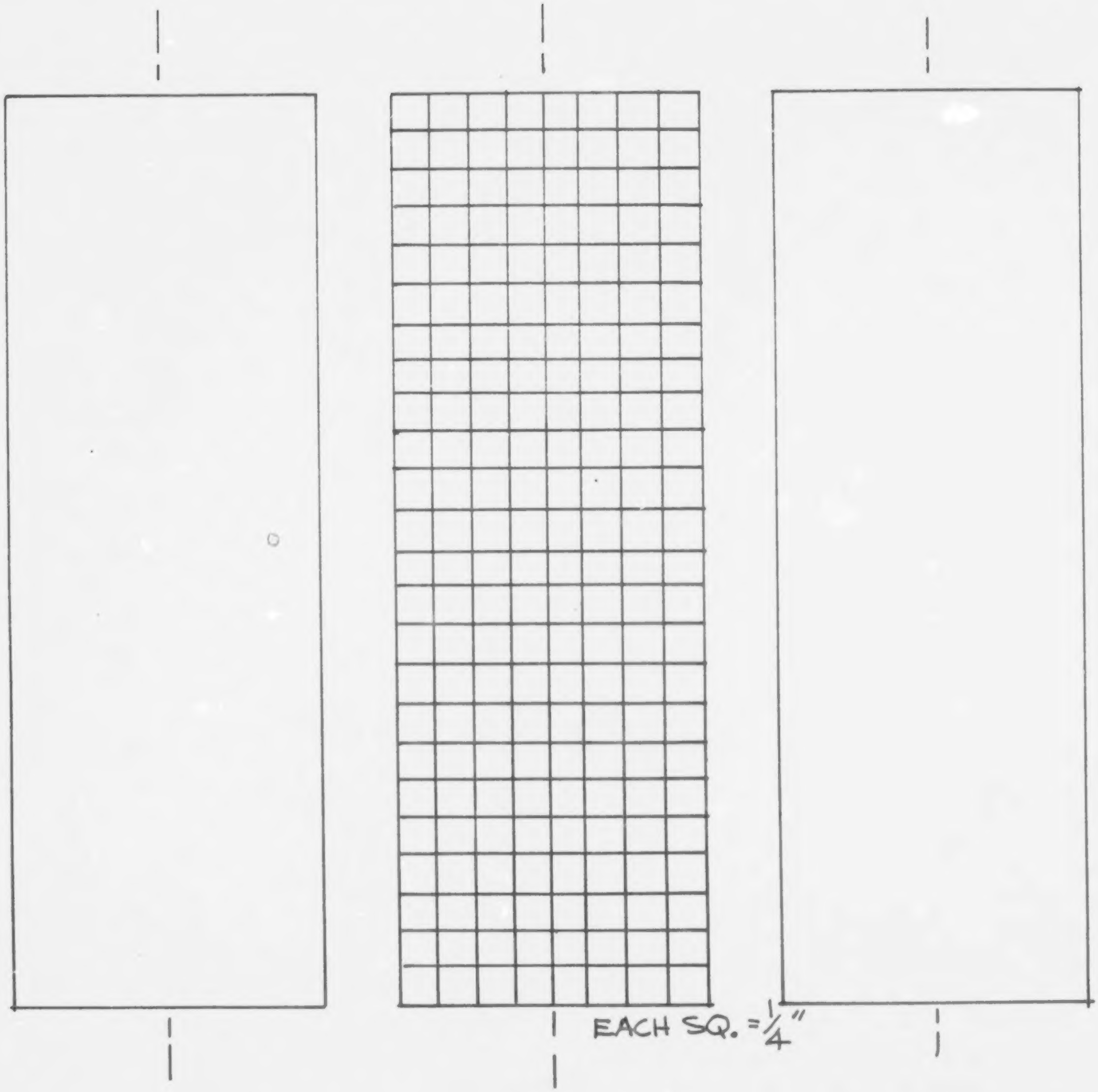
SCALE: 1/2" = 1"



REFINED SOLUTIONS

SCALE: 3/4" = 1"

FINAL SOLUTION



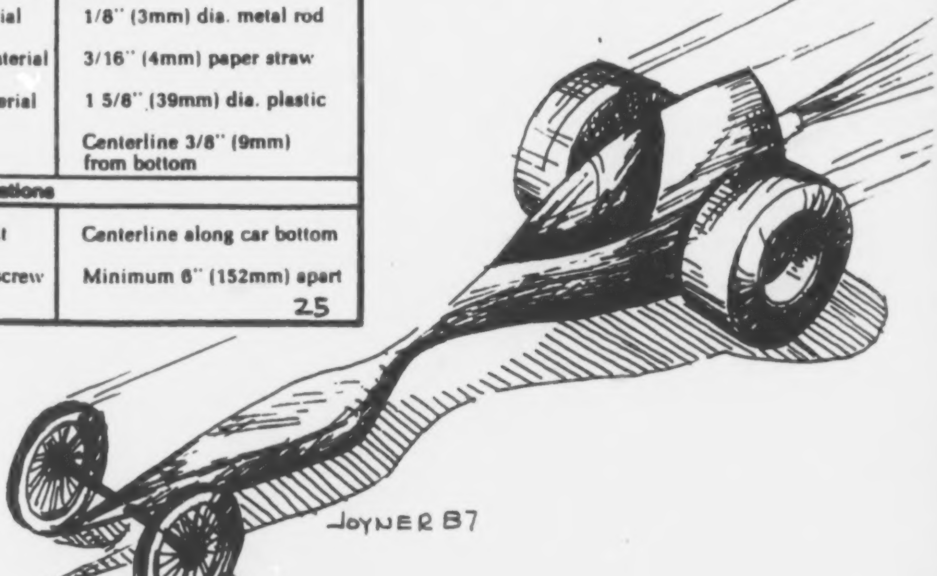
DESIGN

PROBLEM

You are the designer; design the shape of a CO_2 drag racer to be constructed of soft wood. You must stay within the limitations that are provided. Use the attached sheets to sketch and draw your design ideas. Be creative in your thinking.

LIMITATIONS

Factors	Limitations
Body Limitations	
Length	12" (300mm)
Width	1 5/8" (42mm) maximum
Height	2 3/4" (70mm) maximum ,
Shape	3/8" (10mm) min. diameter
Axle housing	Axels must be enclosed
Color	Your choice
Material	Soft wood
Power Plant Limitations	
Size and material	Metal cartridge
Location	1 1/4" (32mm) from bottom of car to center
Housing size	Totally enclosed with 1/8" (3mm) mininimum thickness around cartridge
Axle, Bearing, Wheel Limitations	
Axle size and material	1/8" (3mm) dia. metal rod
Bearing size and material	3/16" (4mm) paper straw
Wheel size and material	1 5/8" (39mm) dia. plastic
Axle location	Centerline 3/8" (9mm) from bottom
Steering System Limitations	
Screw eye alignment	Centerline along car bottom
Distance between screw eyes	Minimum 6" (152mm) apart 25



CO$_2$ DRAGSTER

The CO$_2$ dragster competition will be divided into three classes for the 1987 Technology Fair. They are "Stock", "Unlimited", and "Teacher". The rules for each class are as follows.

*** A STUDENT MAY ENTER ONLY ONE CLASS AND ONE CAR IN THAT CLASS***

The CO$_2$ dragster competition is open to any student. You, as the Industrial Arts Teacher, may wish to invite the other teacher(s) and their students to participate in the contest.

STOCK

Body Limitations	Minimum	Maximum
1 Length	12"(300mm)	12"(300mm)
2. Width (Between Wheels)	1 5/8"(42mm)	1 5/8"(42mm)
3. Height	2 3/4"(70mm)	2 3/4"(70mm)
4. Shape	3/8"(10mm) Dia.	1 5/8"(70mm)
5. Axle Housing	Axles must be enclosed	
6. Color	Your Choice	
7. Material	Soft Wood one piece	

Power Plant Limitations

1. Size	CO$_2$ Cartridge Brand D
2. Location	1 1/4"(32mm)from bottom of car to center
3. Housing size	Totally enclosed with 1/8" (3mm) minimum thickness around cartridge

Axle, Bearing, Wheel Limitations

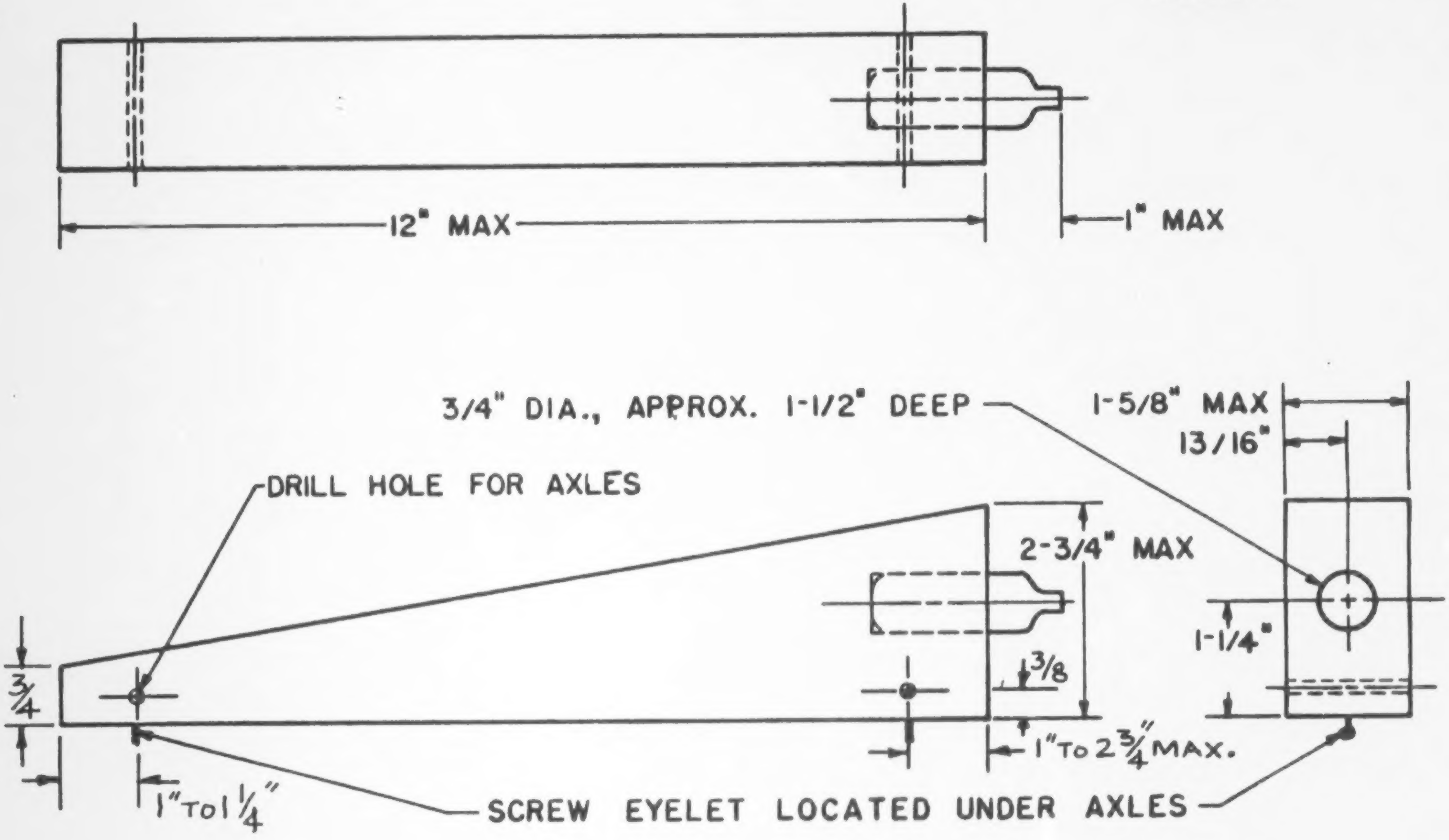
1. Axle size,Material, and Location	1/8"(3mm) Dia. X 2 1/2" metal rod 6" to 10" apart and about 3/8" from the bottom of the body.
2. Bearing size and material	3/16"(4mm) straw
3. Wheel size and material	Front: 1 5/8" (39mm) Dia. X 3/16 (5mm) Rear: 1 5/8" (39mm) Dia. X 3/4" Material: Plastic

Steering System Limitations

1. Screw eye alignment	**Centerline along car bottom**
2. Distance between screw	**Minimum 6"(152mm) apart**

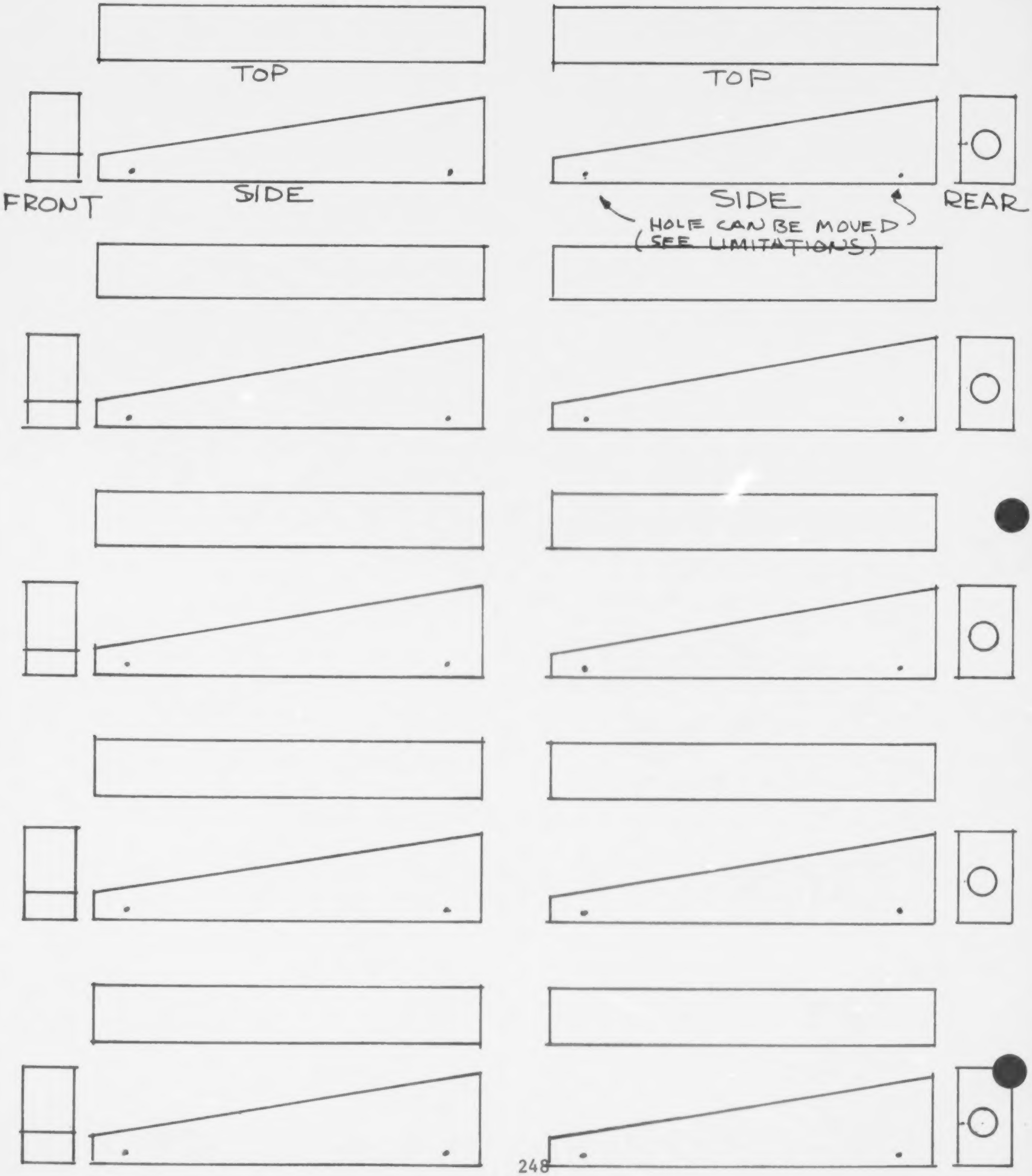
***** The stock dragster must use the materials that are furnished with the PITSCO Dragster Kit or like materila.** 25

8.5 GRAM
CO_2 CARTRIDGE
BRAND D.

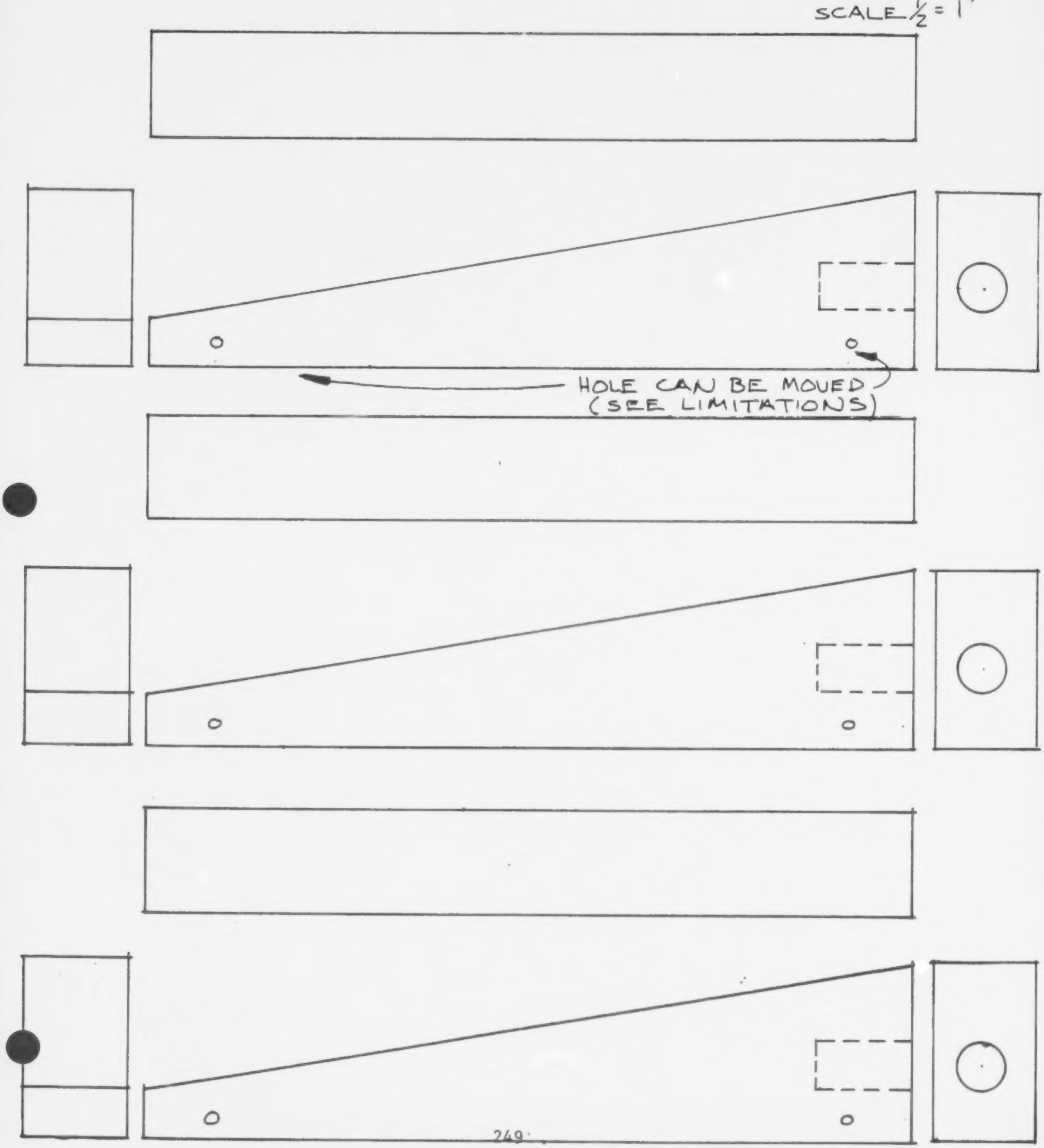

12" MAX
1" MAX
3/4" DIA., APPROX. 1-1/2" DEEP
1-5/8" MAX
13/16"
DRILL HOLE FOR AXLES
2-3/4" MAX
1-1/4"
3/4
3/8
1" TO 2 3/4 MAX.
1" TO 1 1/4"
SCREW EYELET LOCATED UNDER AXLES

SCALE = 1/2" = 1"

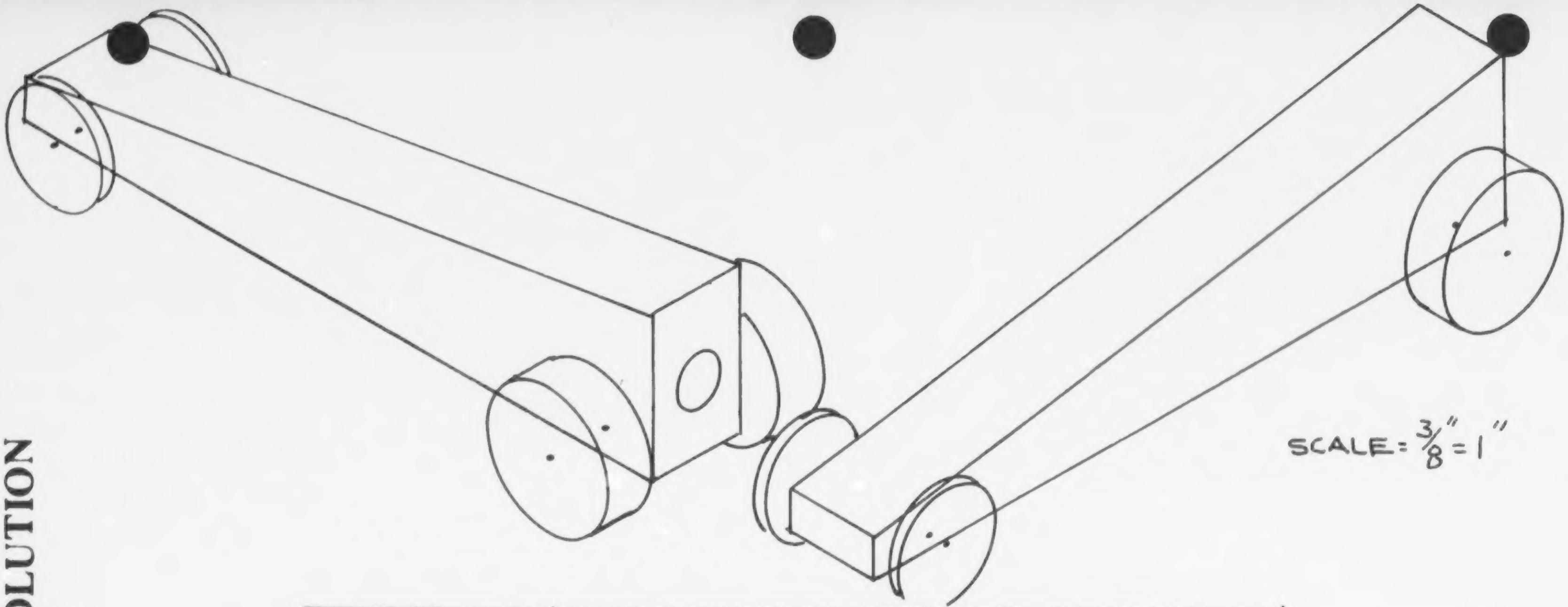
POSSIBLE SOLUTIONS

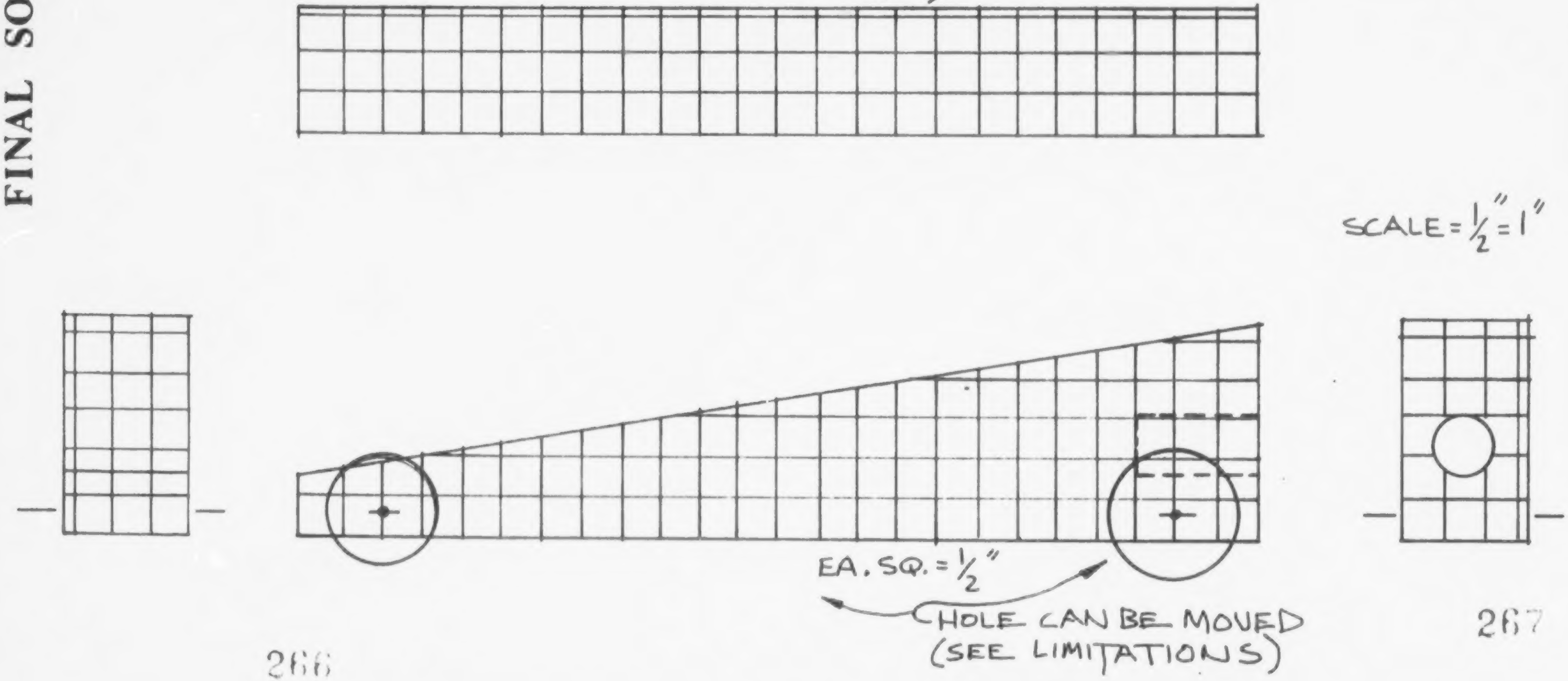

TOP
TOP
FRONT
SIDE
SIDE
REAR
HOLE CAN BE MOVED
(SEE LIMITATIONS)

REFINED SOLUTIONS


SCALE 1/2" = 1"
HOLE CAN BE MOVED
(SEE LIMITATIONS)

FINAL SOLUTION

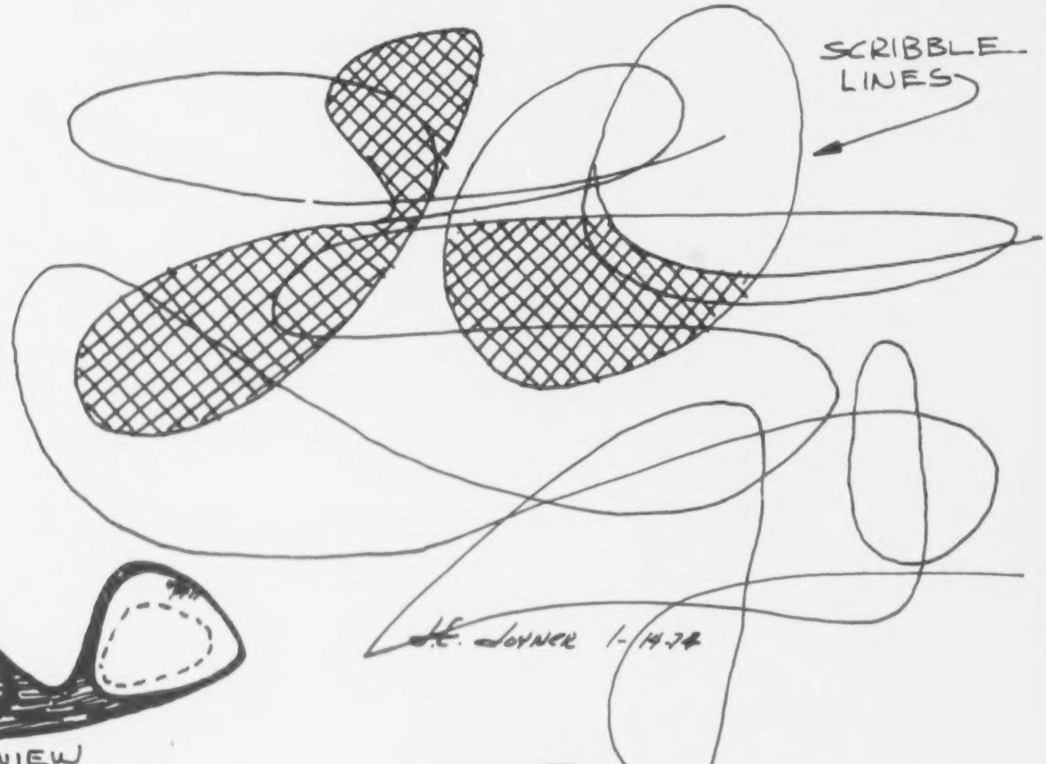



SCALE = 1/2" = 1"
EA. SQ. = 1/2"
HOLE CAN BE MOVED
(SEE LIMITATIONS)

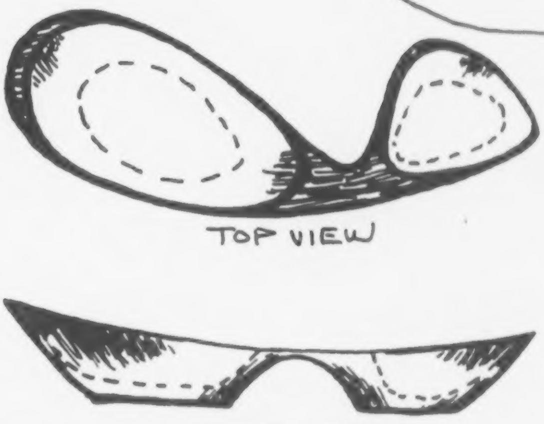
*DESIGN

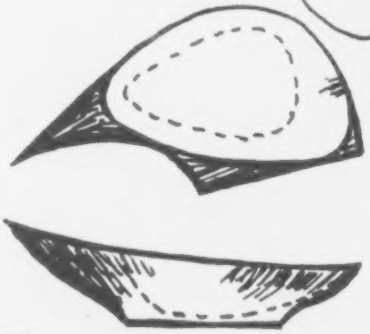
PROBLEM

Using the scribble design technique which is depicted below, design a freeform bowl. Use the sheets provided to sketch your design ideas. Be creative in your thinking.


SCRIBBLE LINES
J.E. Joyner 1-14-74

Example #1


TOP VIEW
FRONT VIEW



Example #2

POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

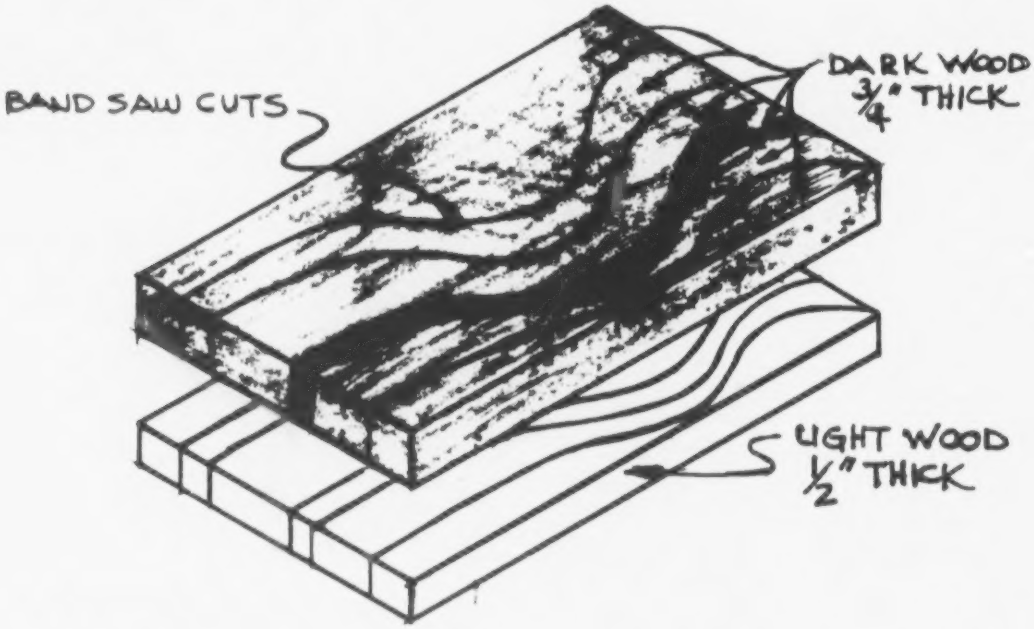
Develop a design for a cutting board and trivet. This design will have a cutting board on one side and the trivet on the other side and will use the method of construction shown below. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

1. Use at least two different kinds of wood
2. Use different thicknesses of wood. 1" and 3/4" or 1/2"
3. Maximum size will be 8" x 14".
4. Construction will be as shown below.

CONSTRUCTION

1. Tape the two boards together.
2. Trace your cuts on the boards.
3. Cut both boards with the band saw at the same time.
4. After cutting, alternate boards and glue.
5. Do not sand edges before gluing.



JOYNER 84

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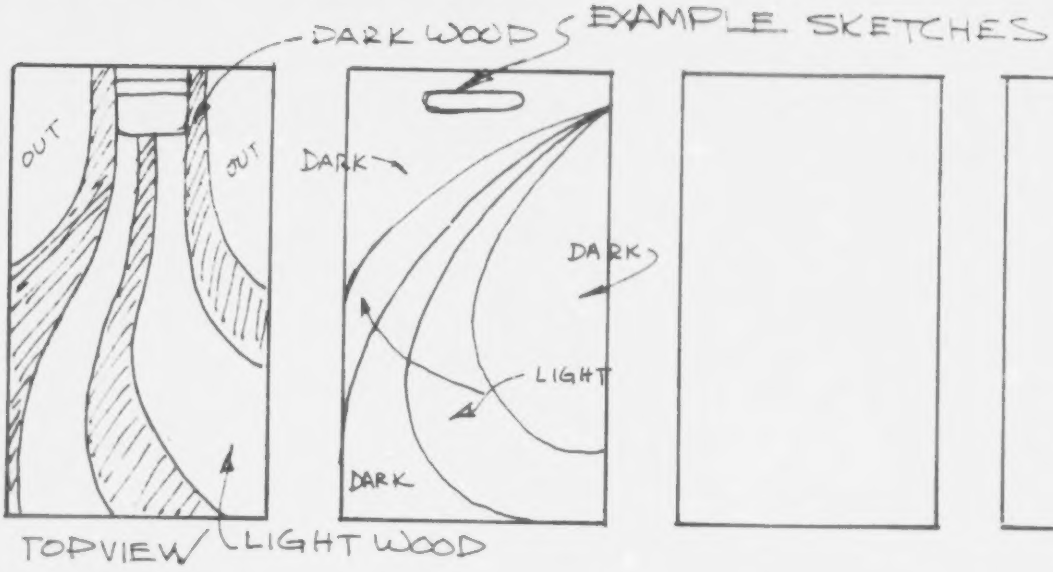
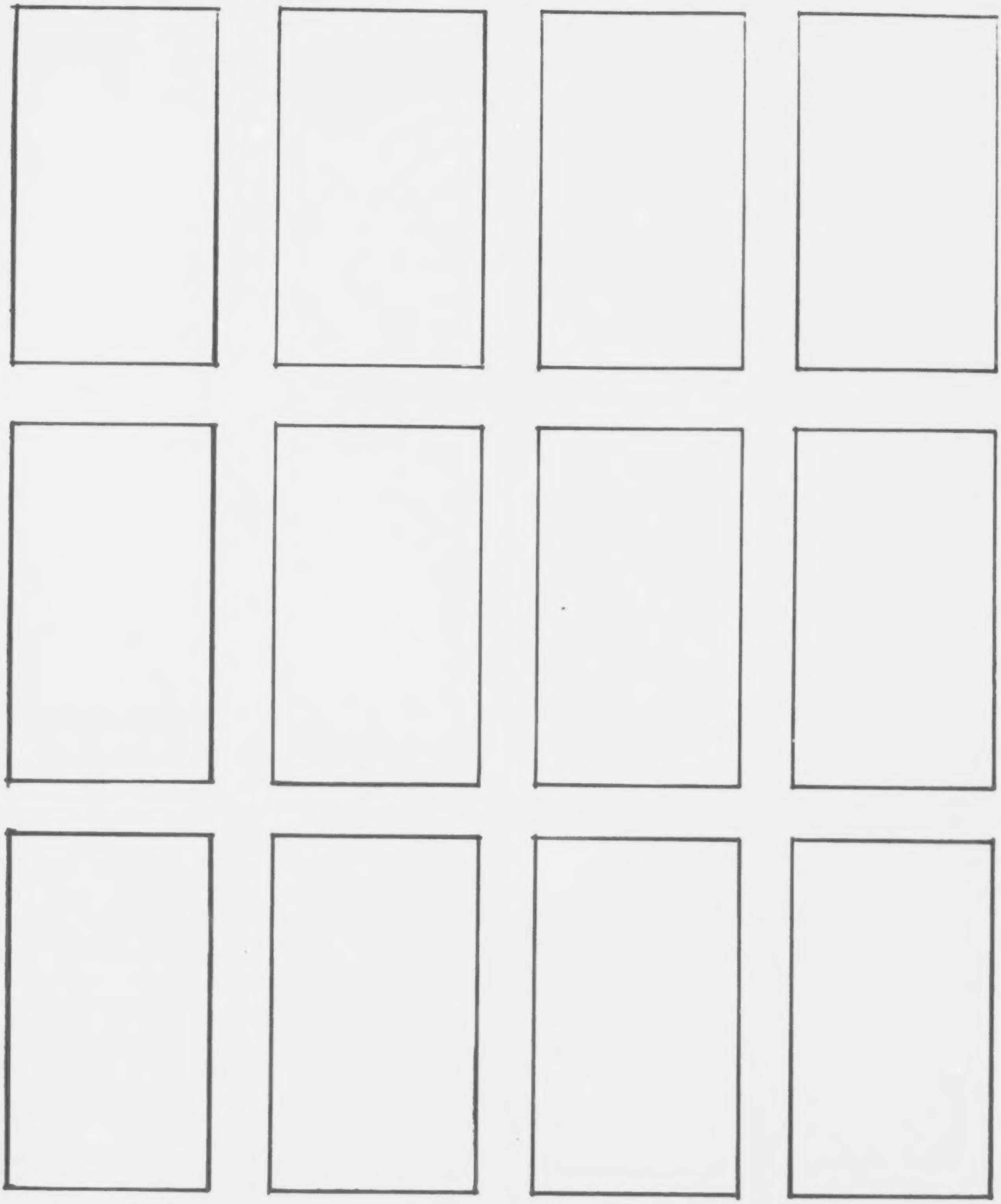
POSSIBLE SOLUTIONS


EXAMPLE SKETCHES
DARK WOOD
OUT
OUT
DARK
DARK
LIGHT
DARK
TOPVIEW
LIGHT WOOD

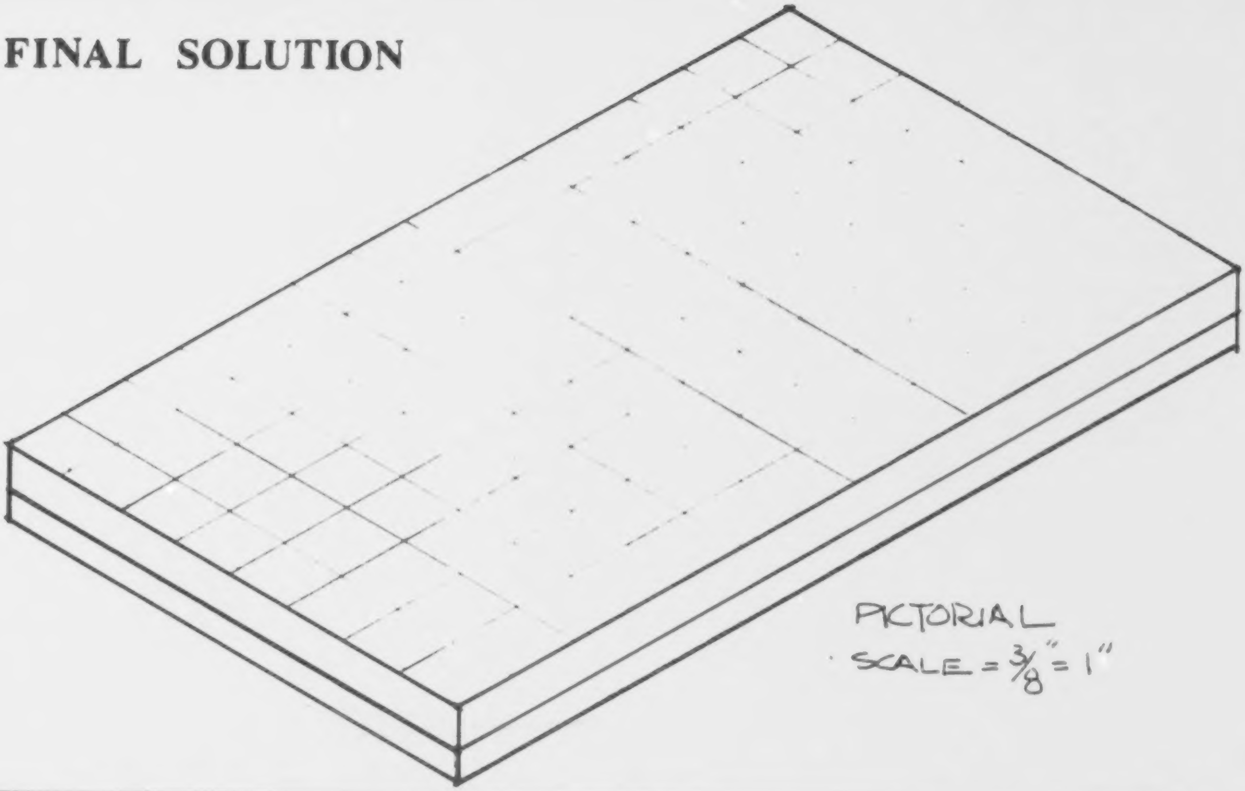
REFINED SOLUTIONS

8" x 14" MAX. SIZE

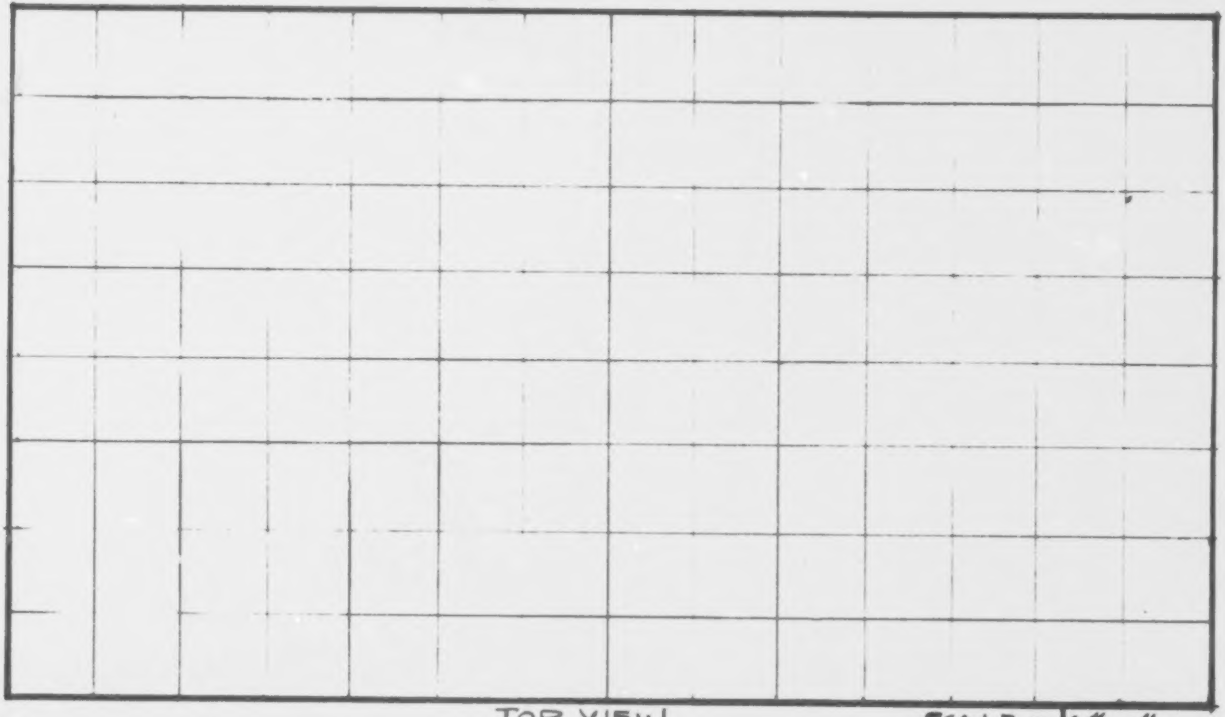


SCALE 3/16" = 1"

FINAL SOLUTION

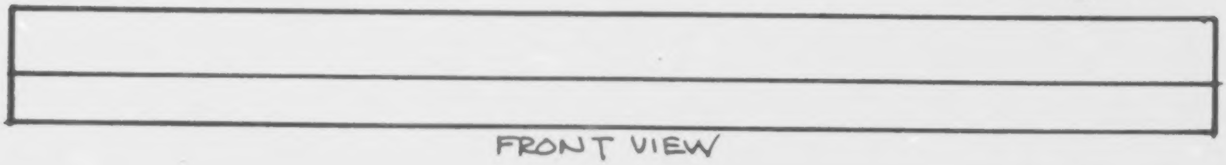


PICTORIAL
SCALE = 3/8" = 1"



TOP VIEW

SCALE = 1/2" = 1"



FRONT VIEW

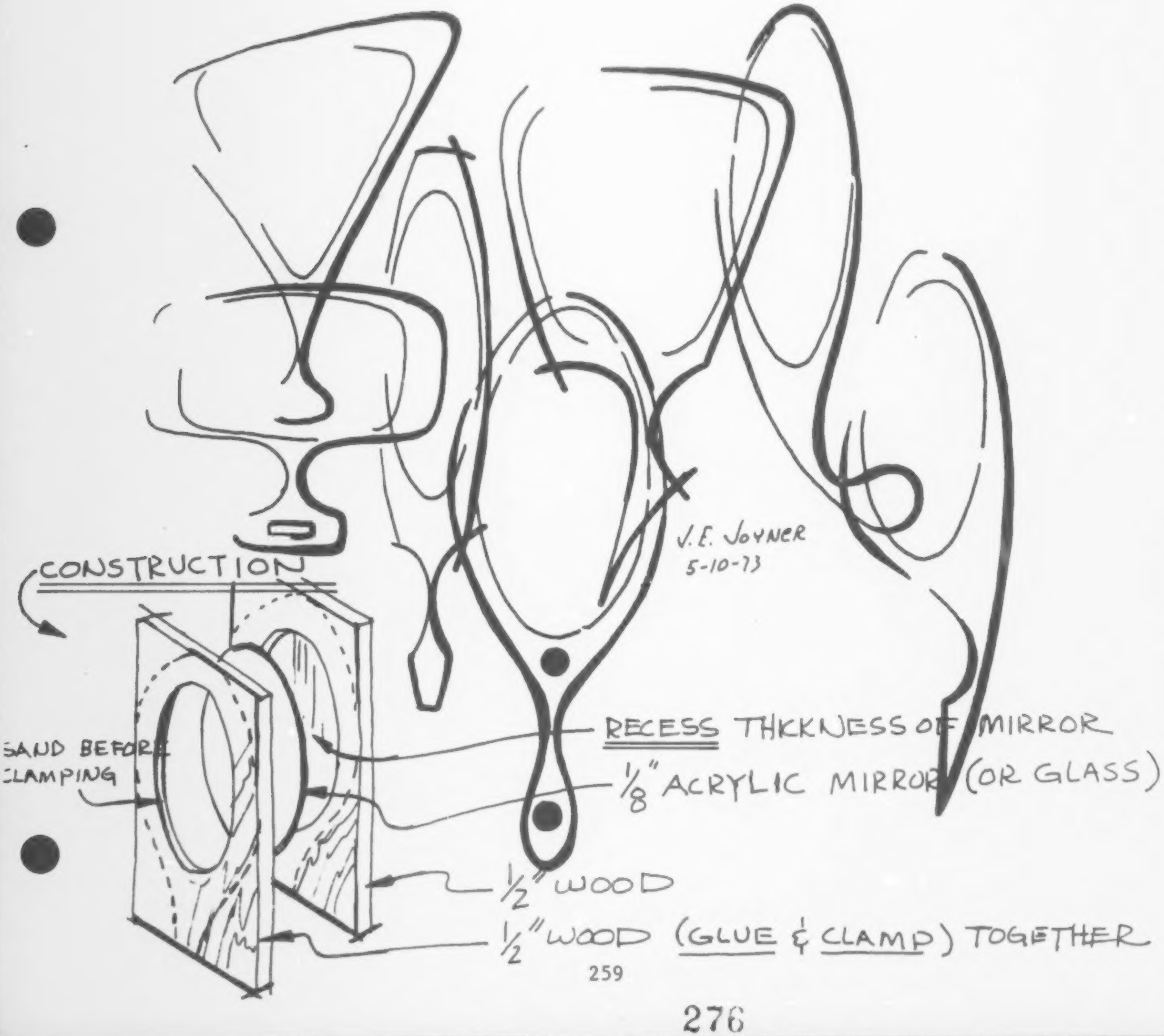
DESIGN

PROBLEM

Develop a design for a hand mirror that would be used in the bedroom or dressing room of the home. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

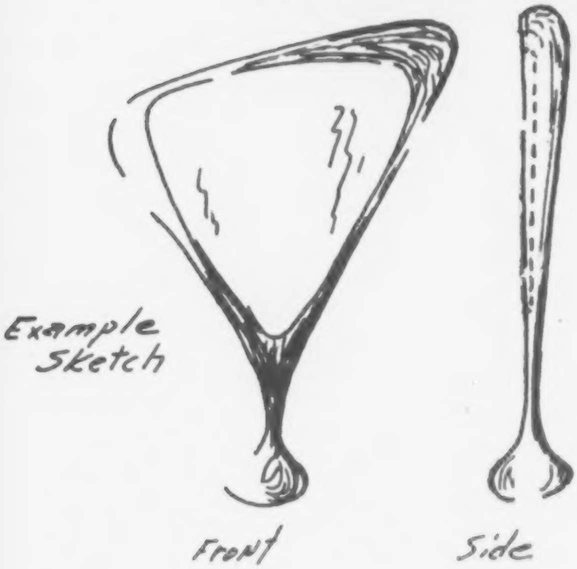
LIMITATIONS

Construction of the final design must be of sculptured wood. Also, keep in mind the weight factor involved.


CONSTRUCTION
SAND BEFORE CLAMPING
RECESS THICKNESS OF MIRROR
1/8" ACRYLIC MIRROR (OR GLASS)
1/2" WOOD
1/2" WOOD (GLUE & CLAMP) TOGETHER

J.E. Joyner
5-10-73

POSSIBLE SOLUTIONS


Example Sketch
Front
Side

REFINED SOLUTIONS

278

FINAL SOLUTION

DESIGN

PROBLEM

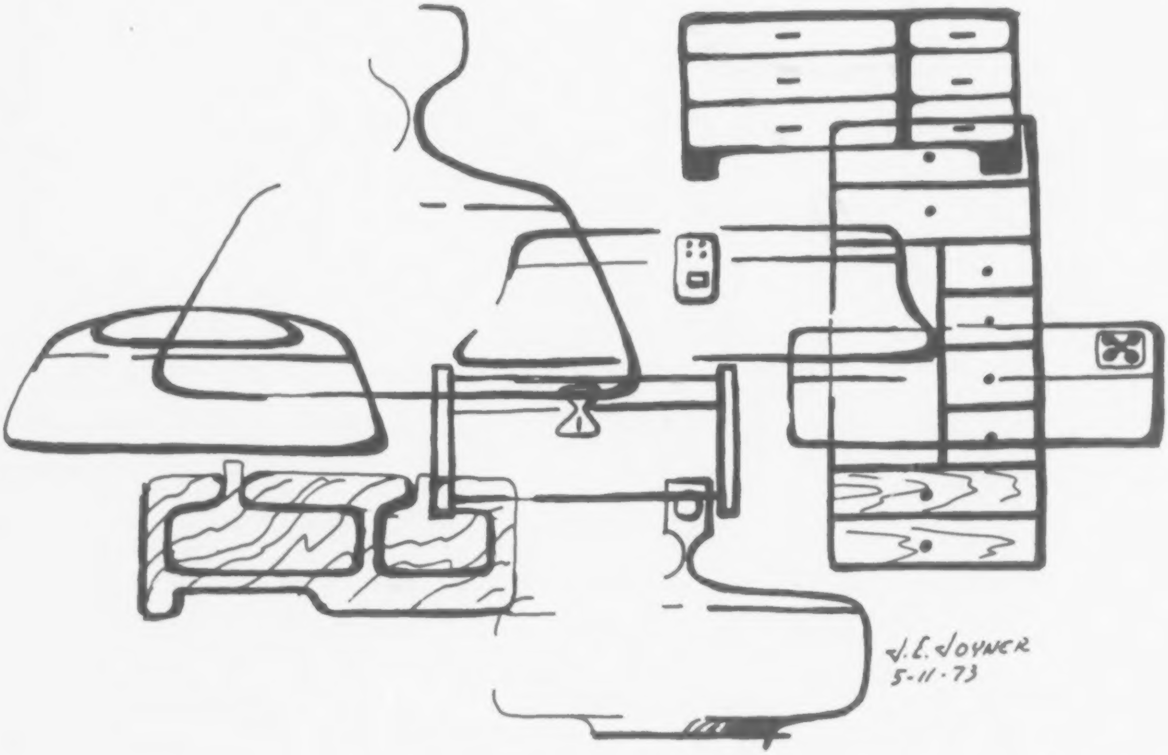
Design a container for storing jewelry when it is not in use. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

Incorporate a music box movement in this design.

MATERIALS

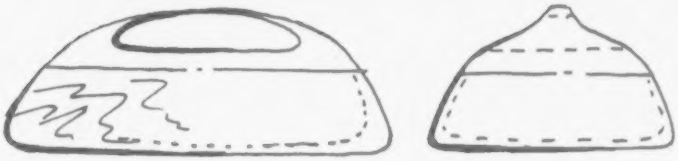
Open



NOTE: Music box movements can be obtained from various school shop supply companies.

POSSIBLE SOLUTIONS

Example Sketch



FRONT

SIDE

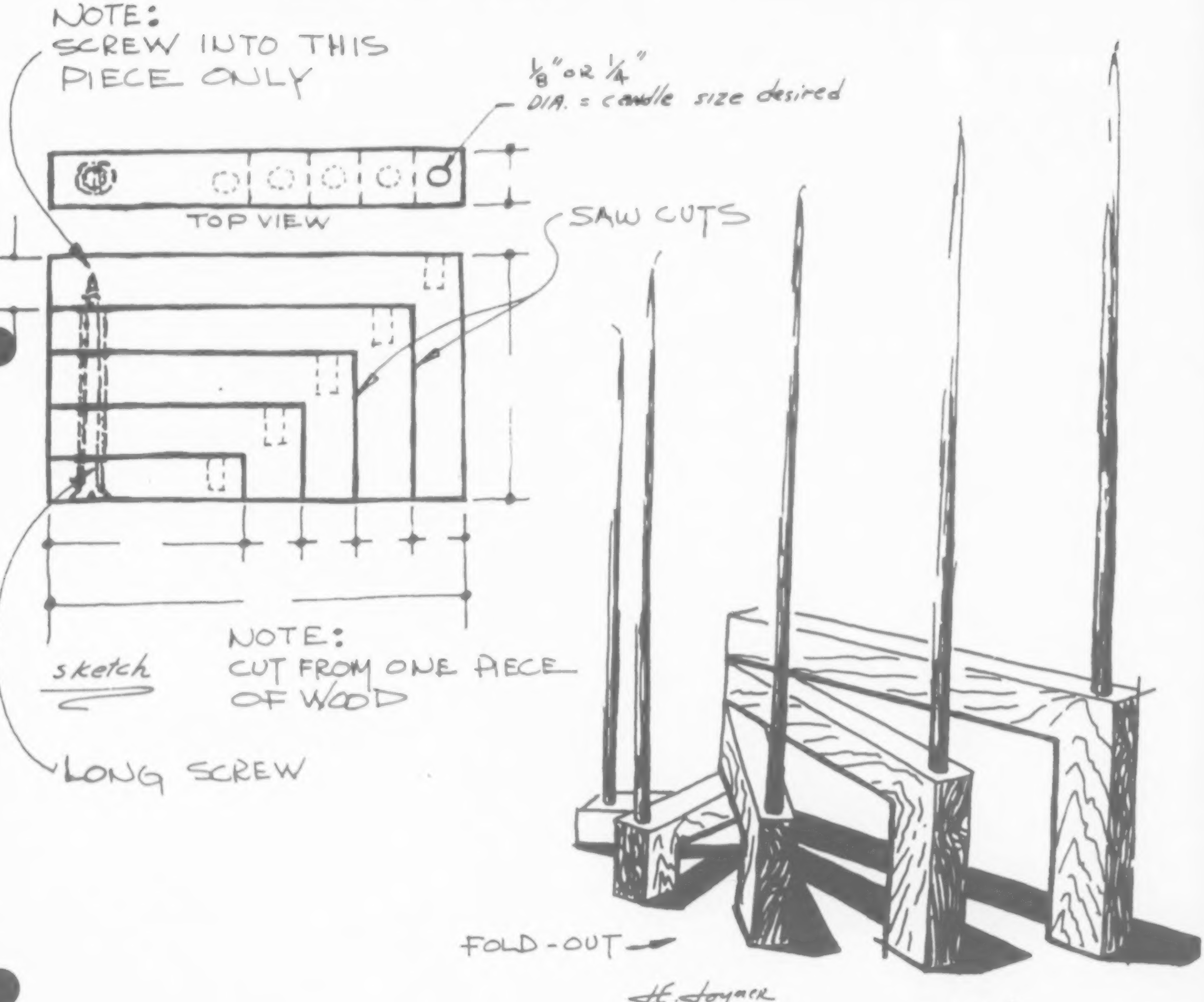
REFINED SOLUTIONS

FINAL SOLUTION

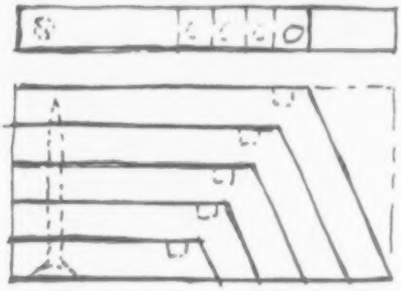
DESIGN*

PROBLEM

Using the principal of the folding candle holder depicted below, redesign the existing candle holder into what you believe to be a more functional and visual appealing design. Use the sheets provided to sketch your design ideas. Be creative in your thinking.


NOTE: SCREW INTO THIS PIECE ONLY
1/8" OR 1/4" DIA. = candle size desired
TOP VIEW
SAW CUTS
NOTE: CUT FROM ONE PIECE OF WOOD
sketch
LONG SCREW
FOLD-OUT
H.E. Joyner
1-14-74
sketch

POSSIBLE SOLUTIONS



EXAMPLE SKETCH

REFINED SOLUTIONS

FINAL SOLUTION

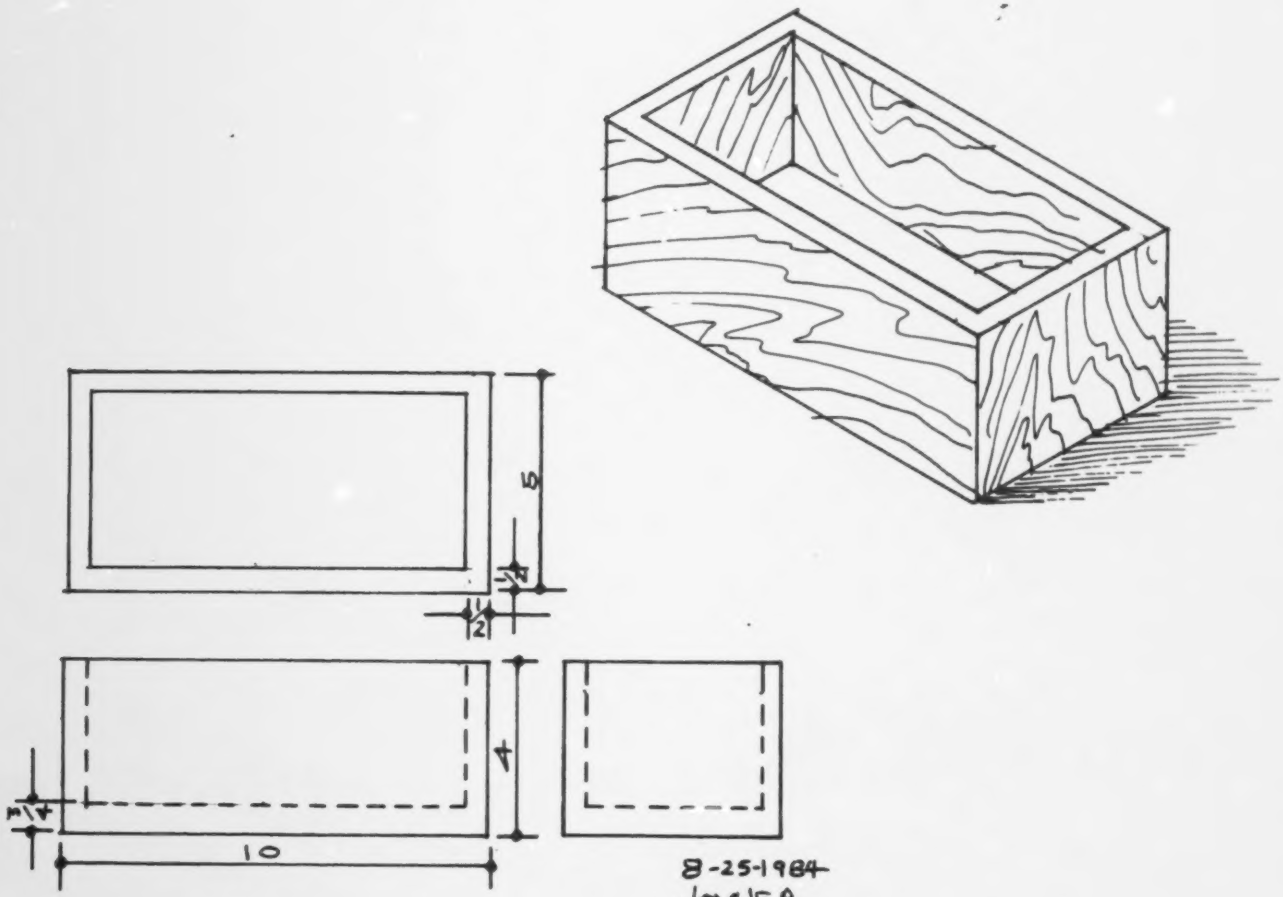
DESIGN

PROBLEM

Given the rectangular wooden container shown below, develop a design for the top.

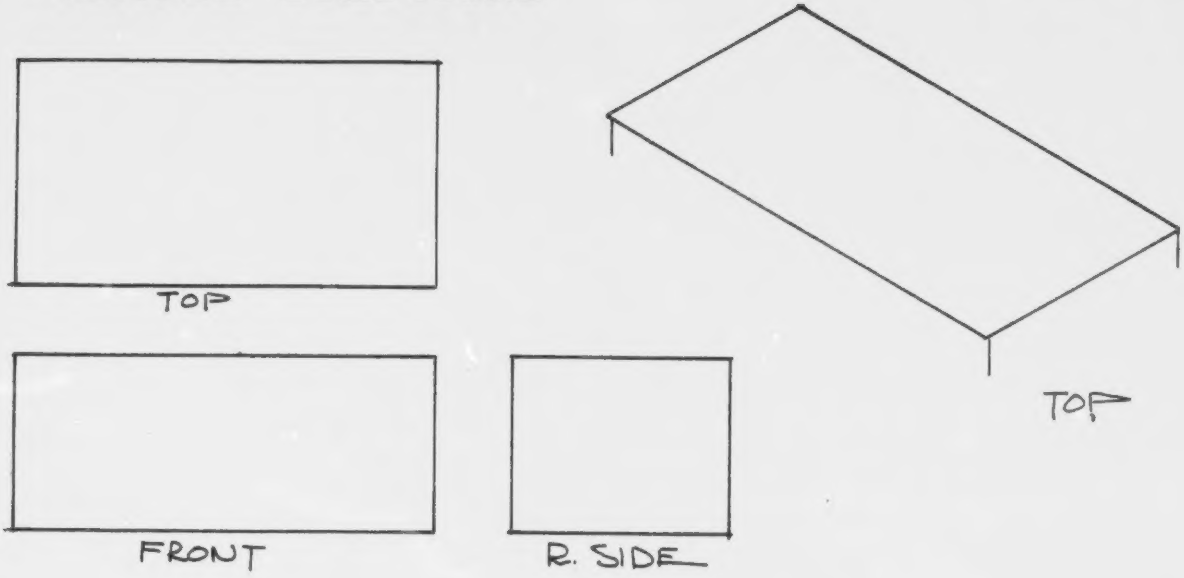
POSSIBLE CONSIDERATIONS

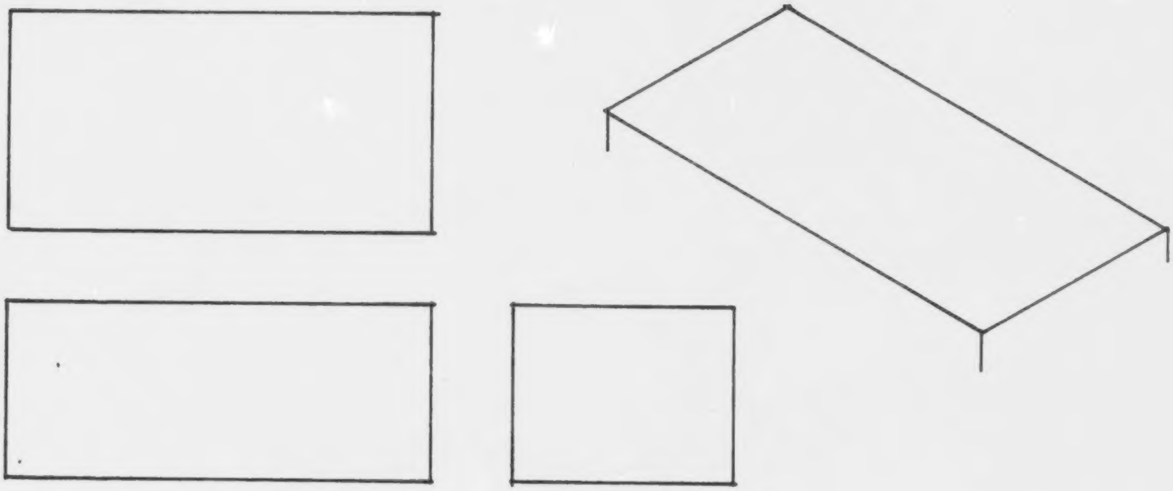
1. The size of the container.
2. How the top will be removed (hinged, slide, swivel, lift off, etc.
3. Removable compartments.
4. Some alterations can be made to the existing container.

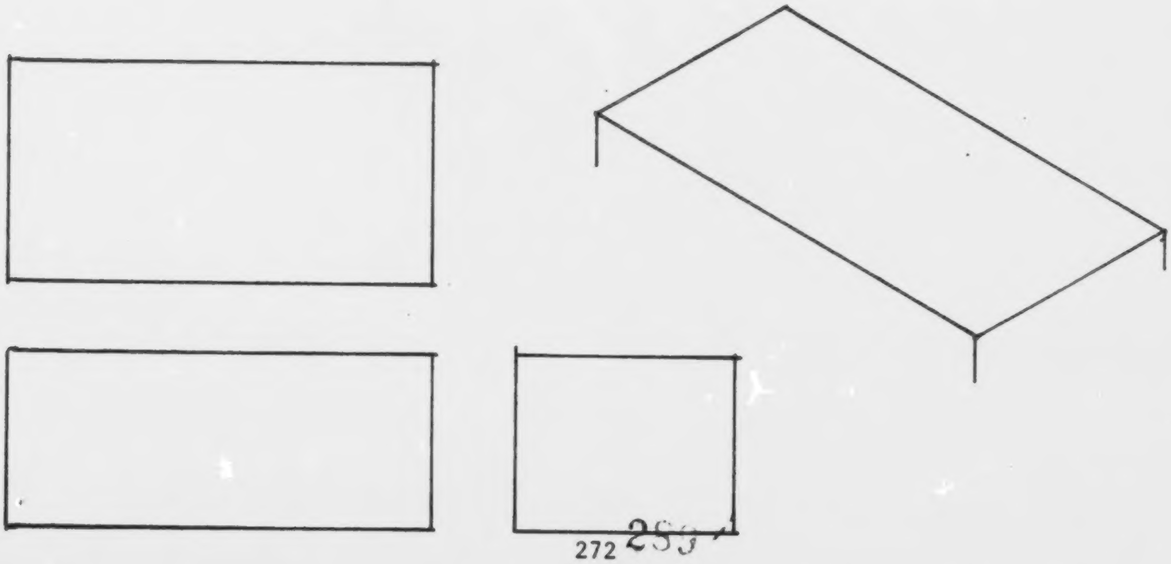


8-25-1984
JOYNER

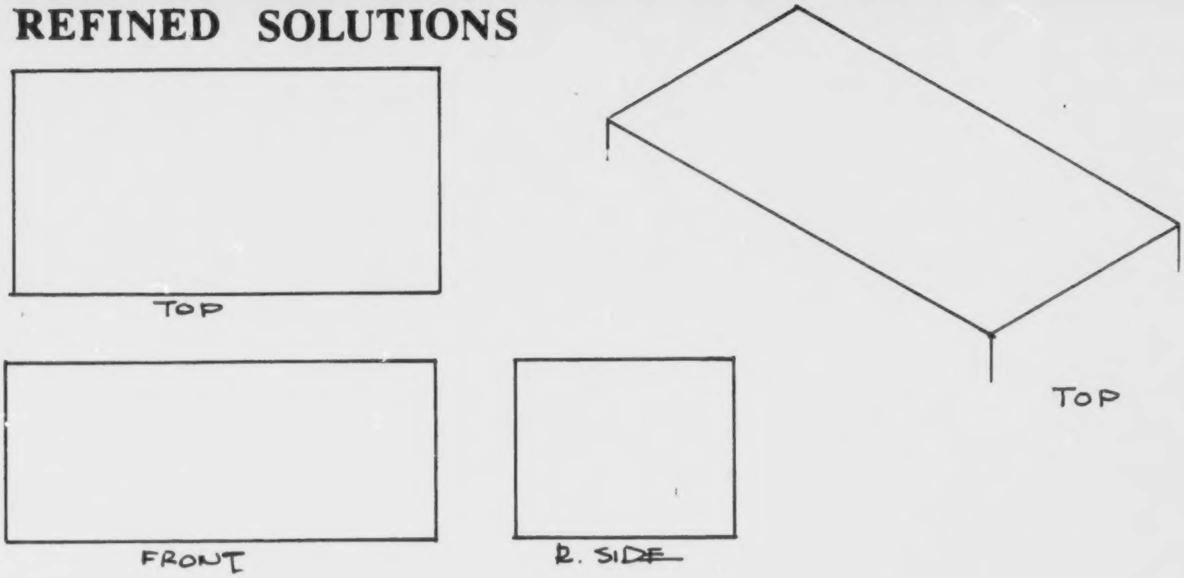
POSSIBLE SOLUTIONS

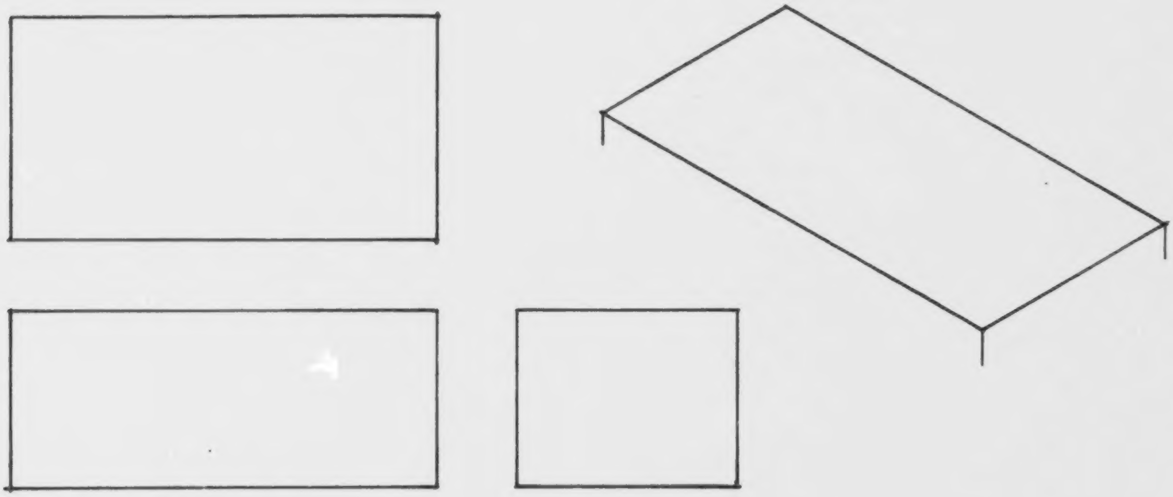

TOP
FRONT
R. SIDE
TOP

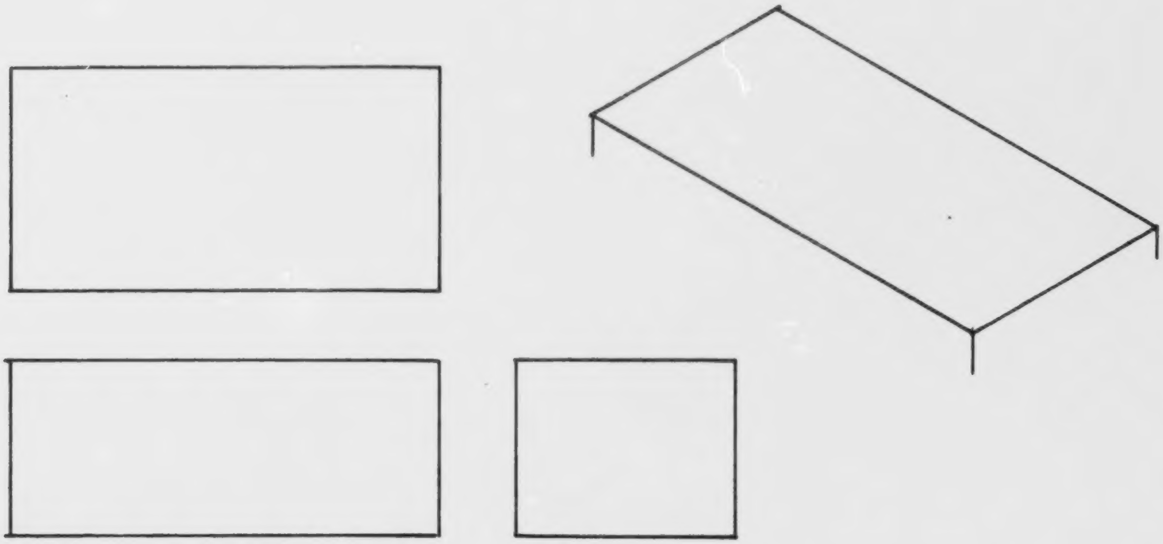




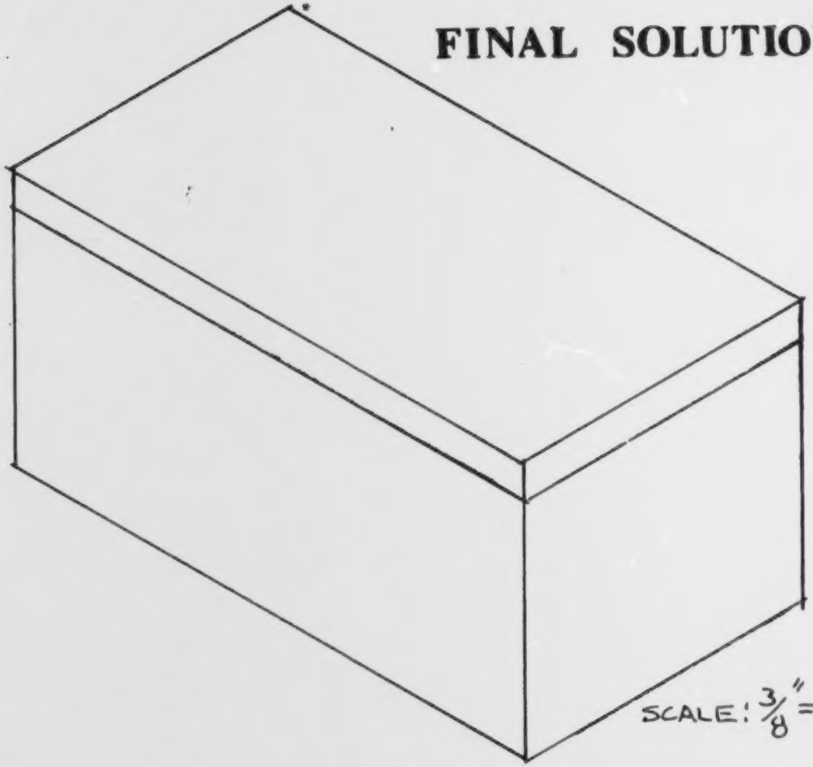
REFINED SOLUTIONS


TOP
TOP
FRONT
R. SIDE

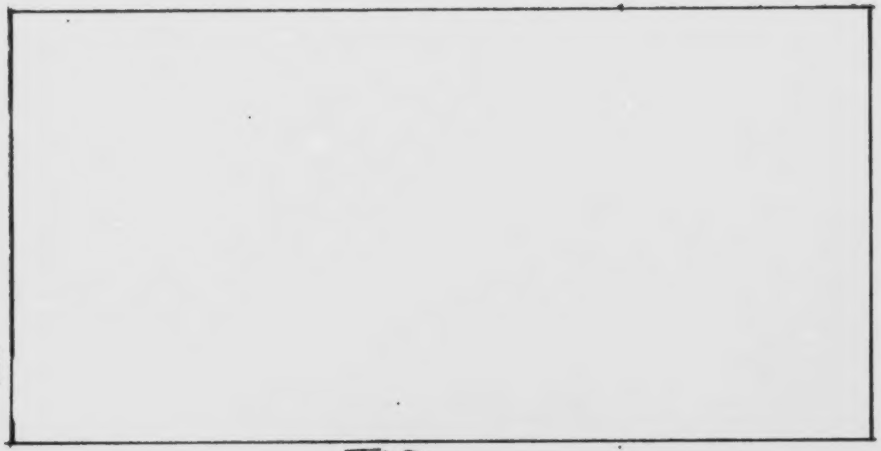




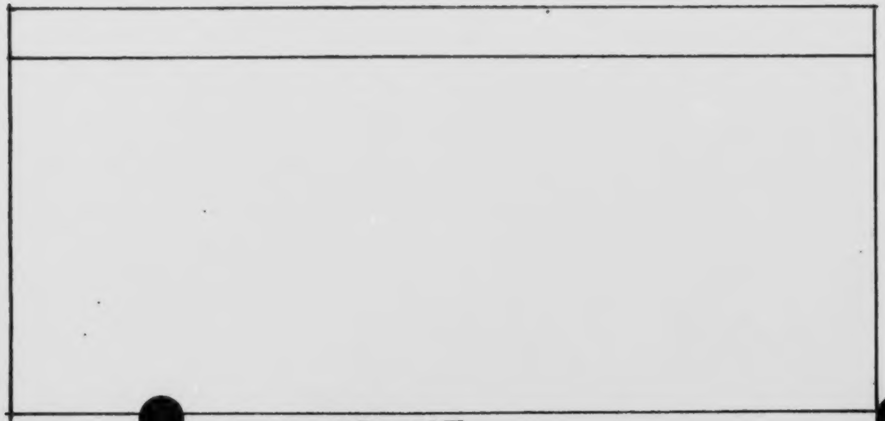
FINAL SOLUTION



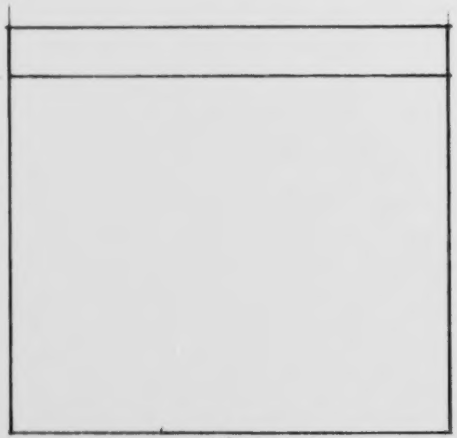
SCALE: $\frac{3}{8}$" = 1"



TOP



FRONT



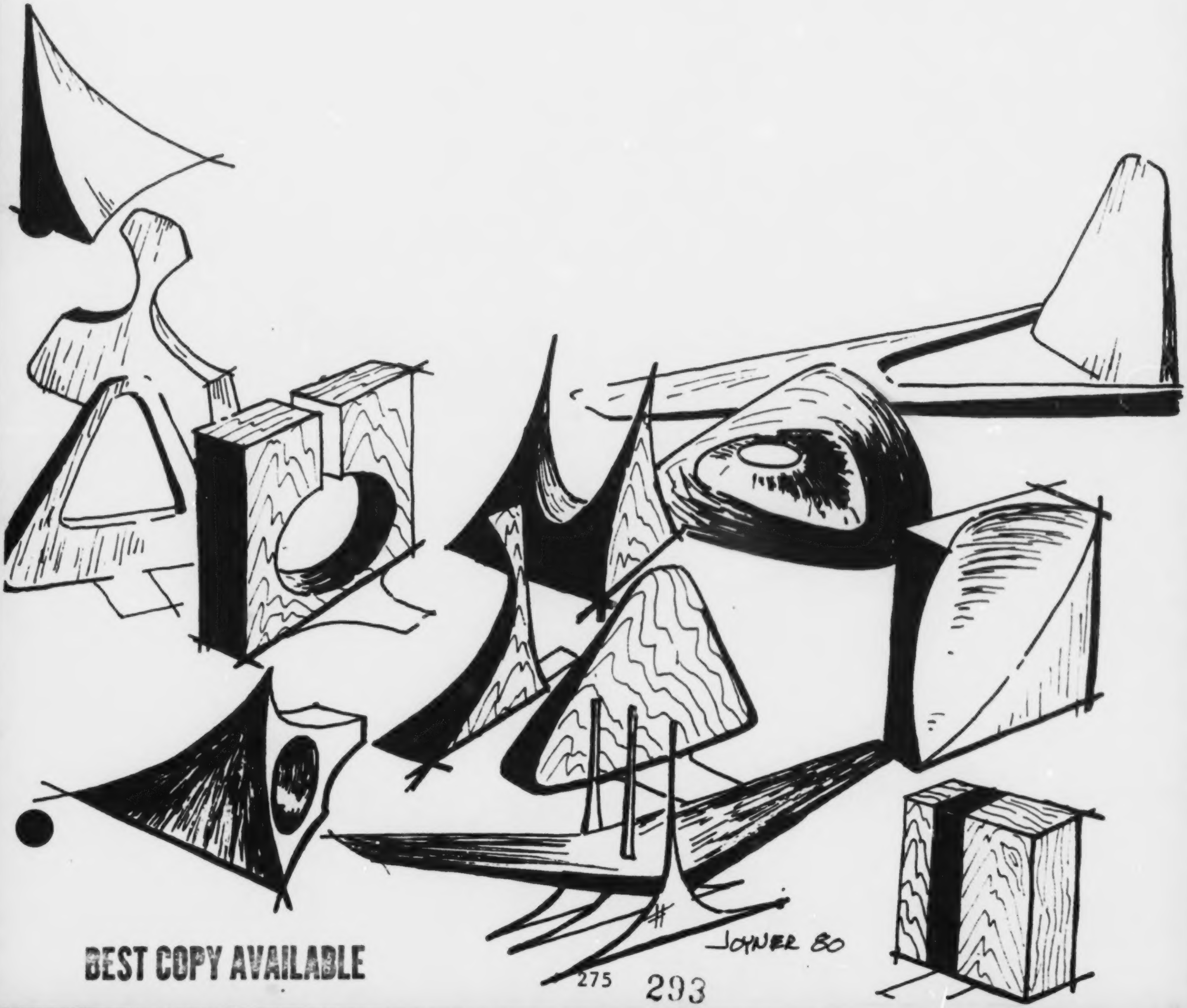
SIDE

SCALE $\frac{1}{2}$" = 1"

design * problem *

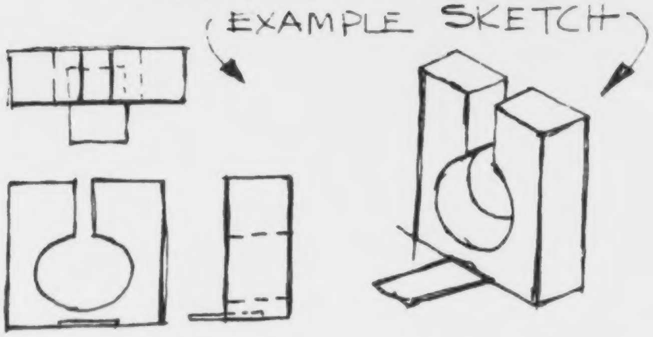
PROBLEM

Design a device that would hold or support at least six books. Use the sheets provided to develop your ideas. Be ceative in your thinking.



BEST COPY AVAILABLE

POSSIBLE SOLUTIONS


EXAMPLE SKETCH

REFINED SOLUTIONS

FINAL SOLUTION

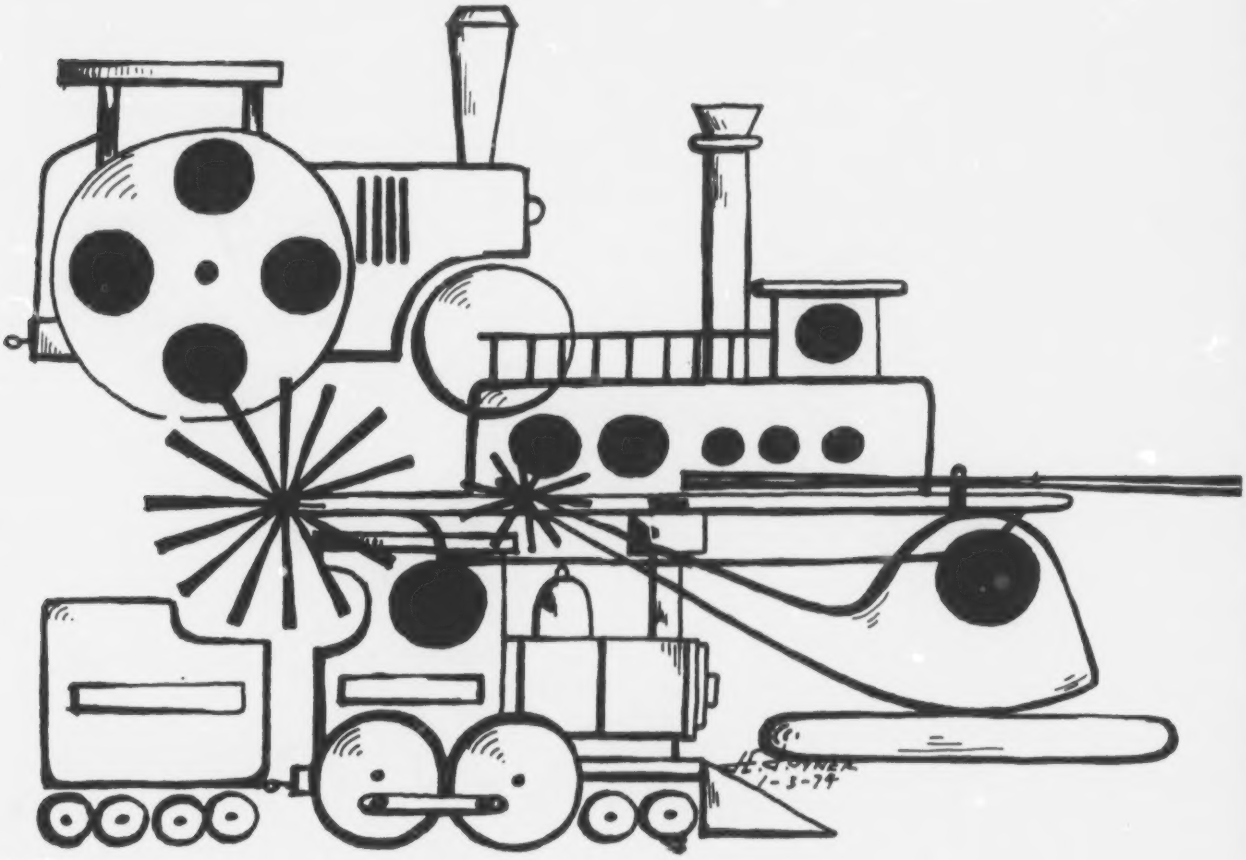
DESIGN

PROBLEM

Develop a design for a unique wooden toy. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

The major portion of the design must be constructed of wood, although small amounts of other materials and different kinds of woods could be used in the design.



POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

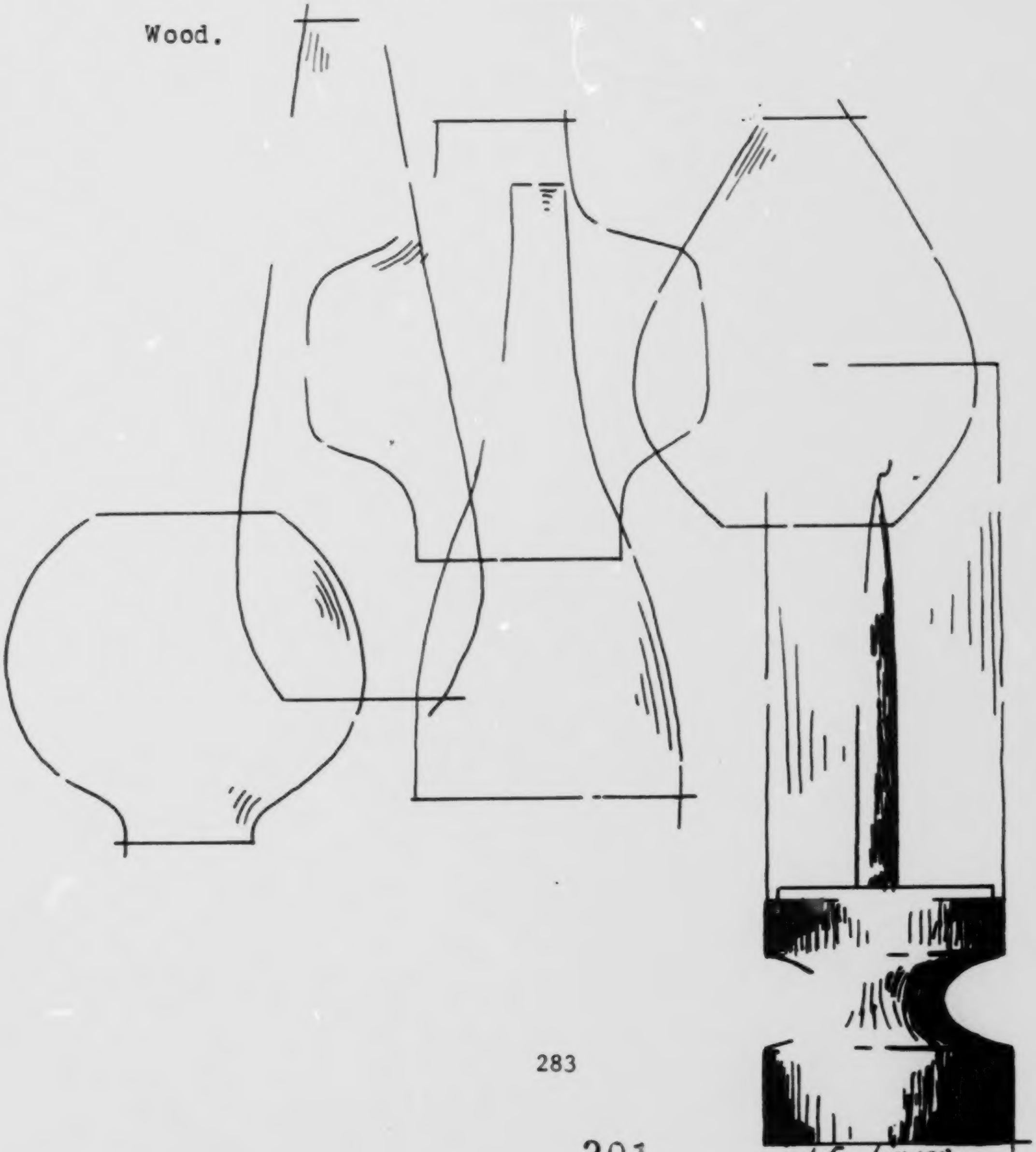
Using a lamp globe or chimney that can be purchased from a local hardware or lighting fixture supply store, design a candle holder. Use the sheets that are provided to sketch your ideas. Be creative in your thinking.

LIMITATIONS

You must consider the size and shape of your lamp chimney and the size candle to be used before designing an attractive base.

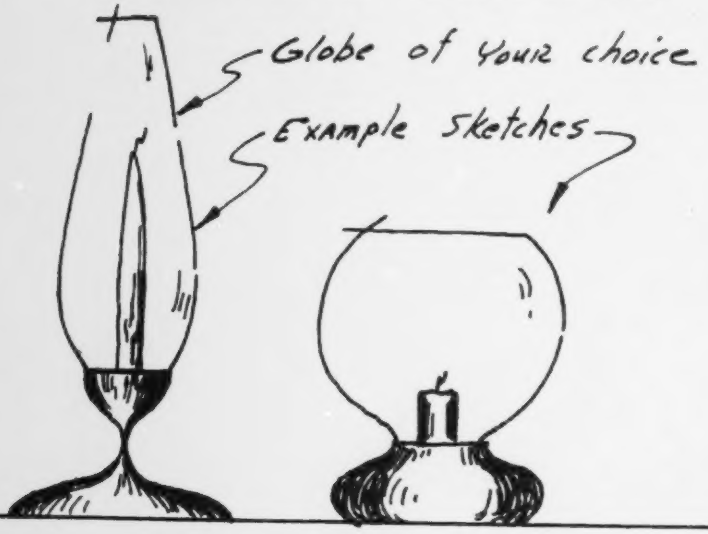
MATERIALS

Wood.



J.E. Joyner
5-10-73

POSSIBLE SOLUTIONS


Globe of Your choice
Example Sketches

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

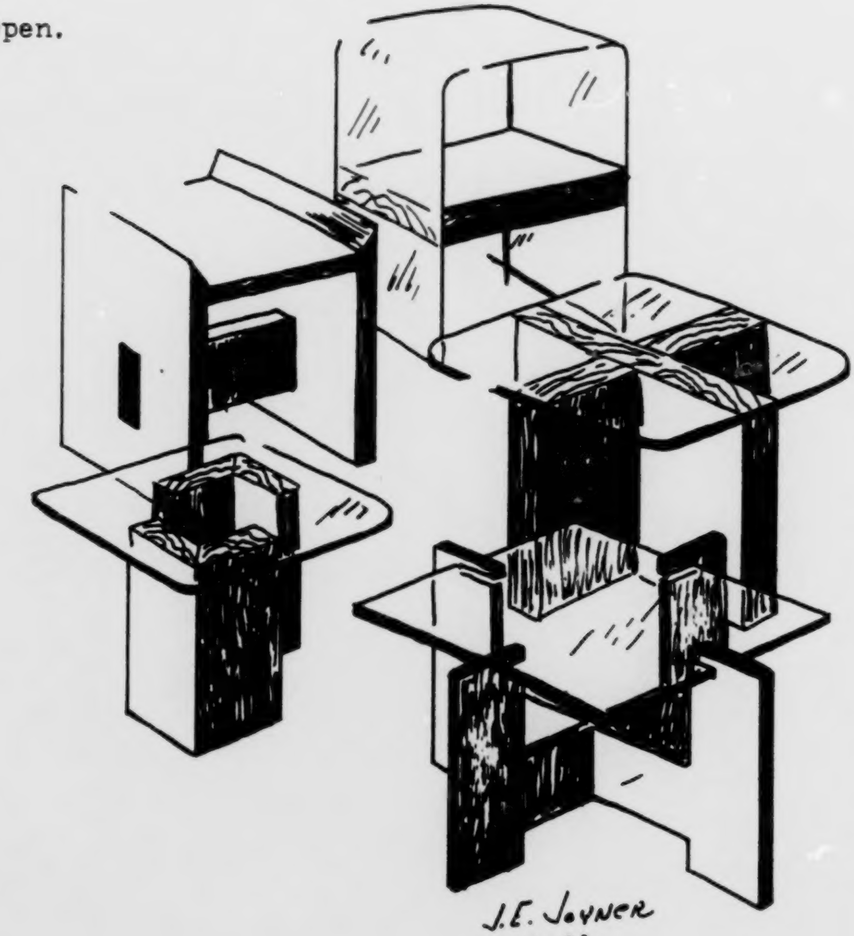
Design an end table to be used in the living room or family room of the home. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

This end table is to be 18" in height and no longer than 2'0" sq.

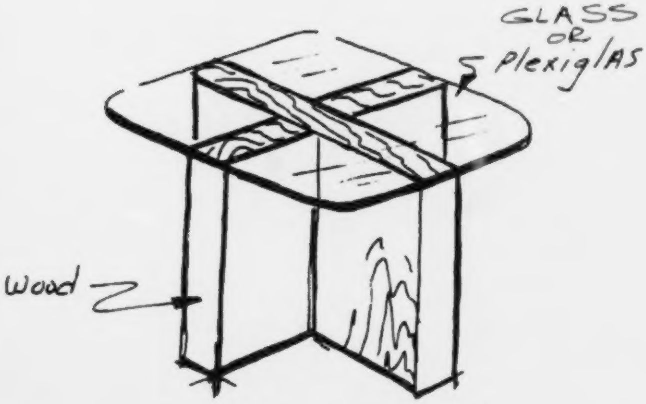
MATERIALS

Open.



J.E. Joyner
5-10-73

POSSIBLE SOLUTIONS


GLASS
OR
Plexiglas
Wood

Example Sketch

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

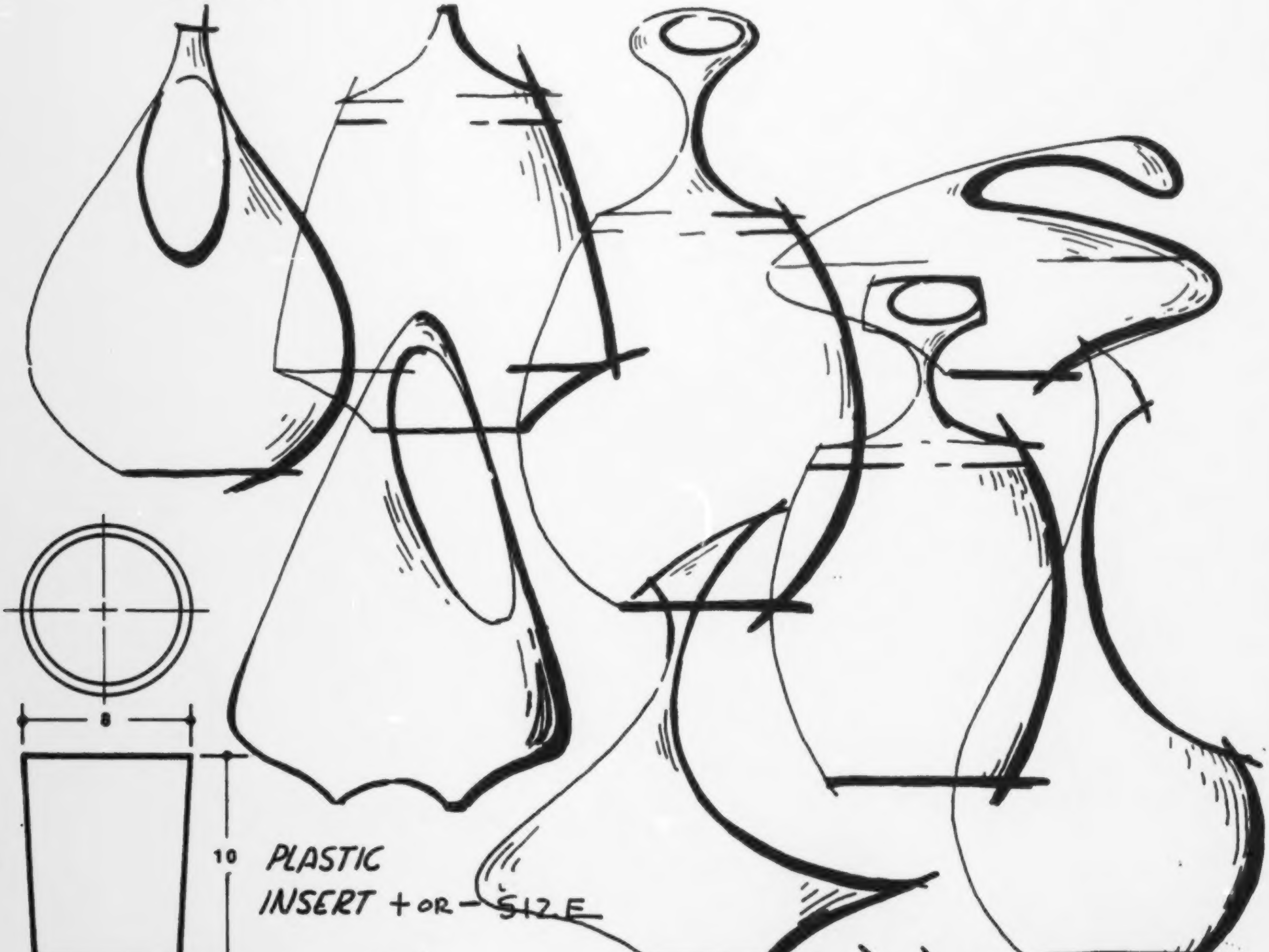
Design a container that is capable of holding and keeping ice for a short period of time. This container should be functional, unique, visually appealing and possibly serve another purpose when not in use.

LIMITATIONS

Using the removable plastic insert as your interior lining, develop your design sketches on the sheets provided. This insert is shown below and can be altered to fit a particular design situation. Keep in mind that some portion of your design must be turned in the wood lathe and some hand sculpture must be employed. The maximum diameter will be 12" and the maximum height of your container is 20". Develop as many solutions as you can in the allotted time. Be creative in your thinking.

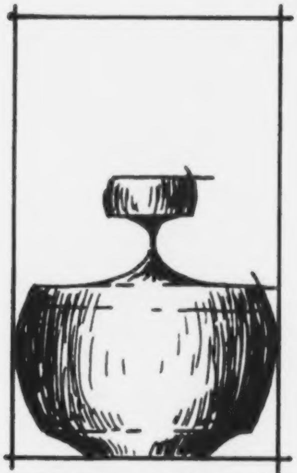
MATERIAL

Hardwood



J. Joyner
4-7-72

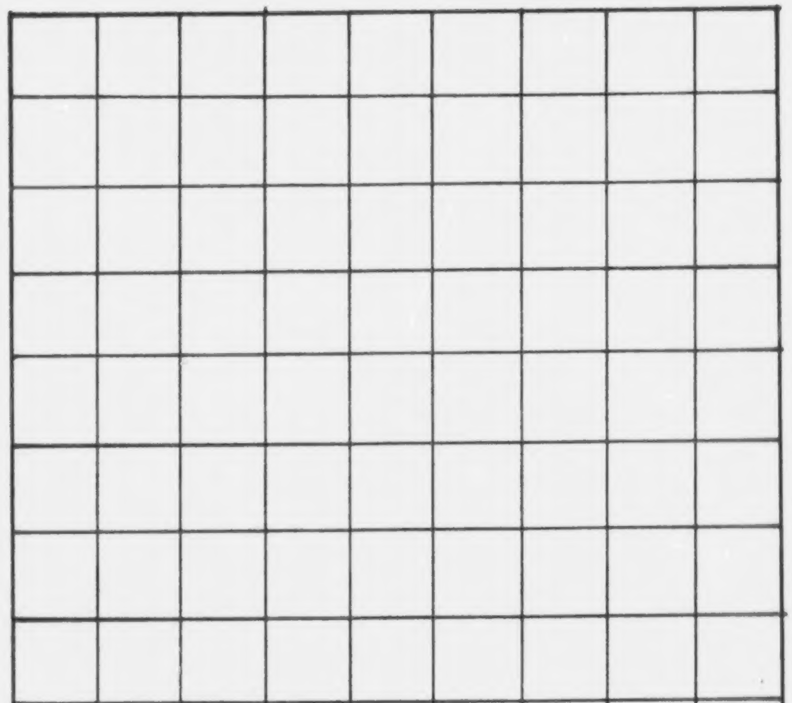
POSSIBLE SOLUTIONS *



EXAMPLE SKETCH

REFINED SOLUTIONS ✻

FINAL SOLUTION ✻



SCALE = $\frac{1}{2}$" = 1"

DESIGN

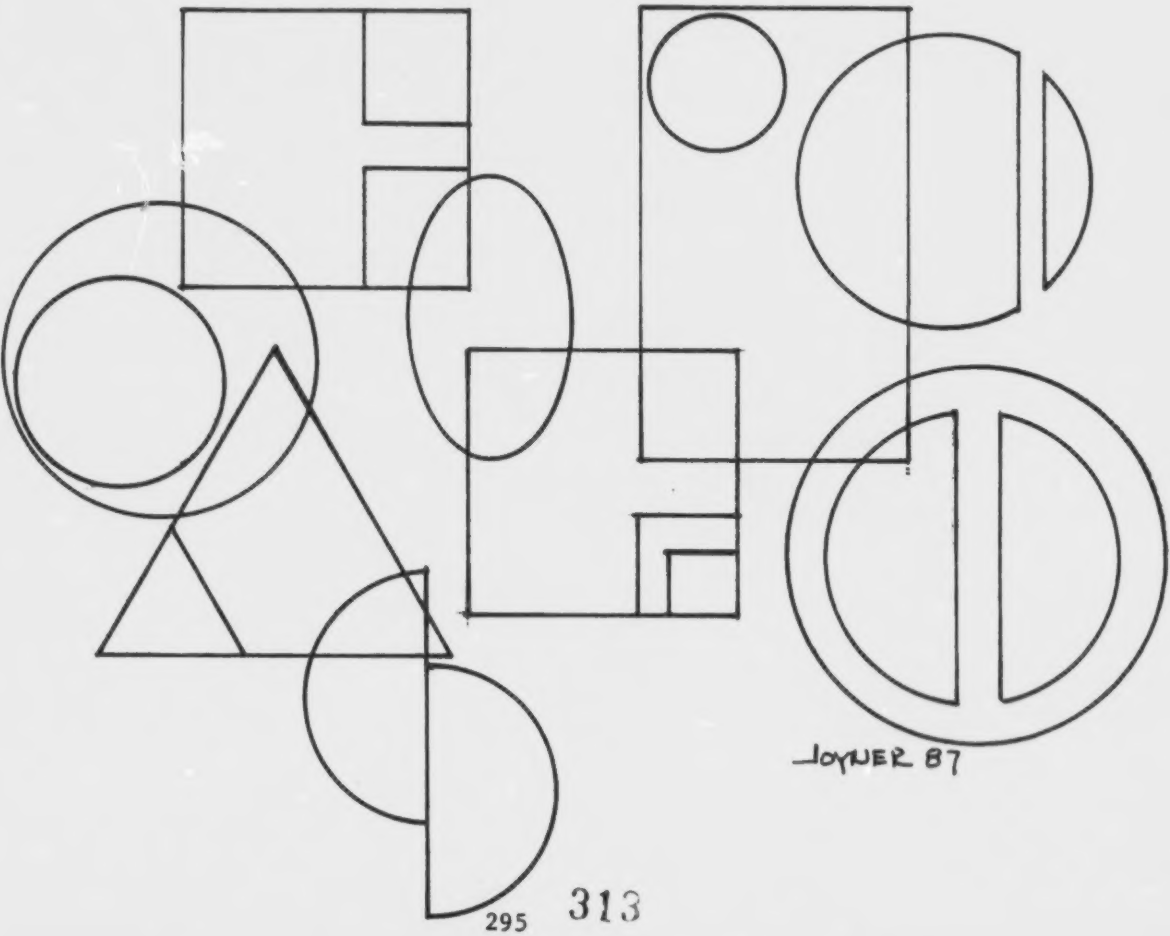
PROBLEM

Design a wall mounted clock that will be constructed of sheet acrylic. Use the sheets provided to sketch and draw your creative ideas.

LIMITATIONS

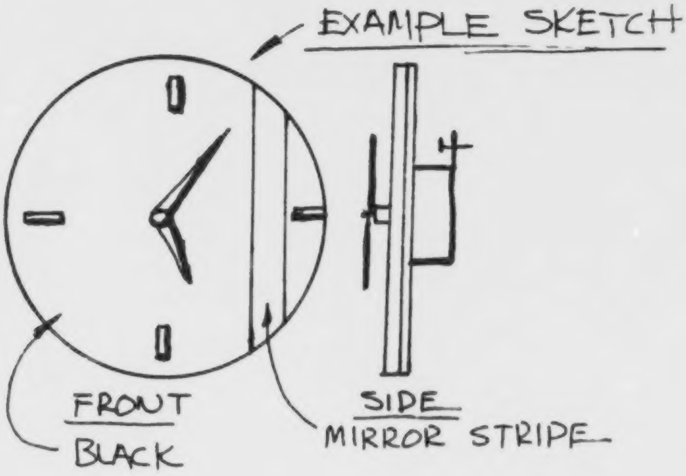
This clock will be wall mounted and will be constructed of two kinds of acrylic sheets. Use 1/4" black and 1/8" mirror acrylic in the construction. Note the length of the clock movement shaft when designing.

NOTE: Acrylic can be obtained from AIN Plastics, Mt.Vernon, New York. Phone (914) 668-6800. Clock movements, hands, numerals and other accessories can be obtained from KLOCKIT, Lake Geneva, WI. Phone (1-800-556-2548).



JOYNER 87

POSSIBLE SOLUTIONS


EXAMPLE SKETCH
FRONT
BLACK
SIDE
MIRROR STRIPE

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

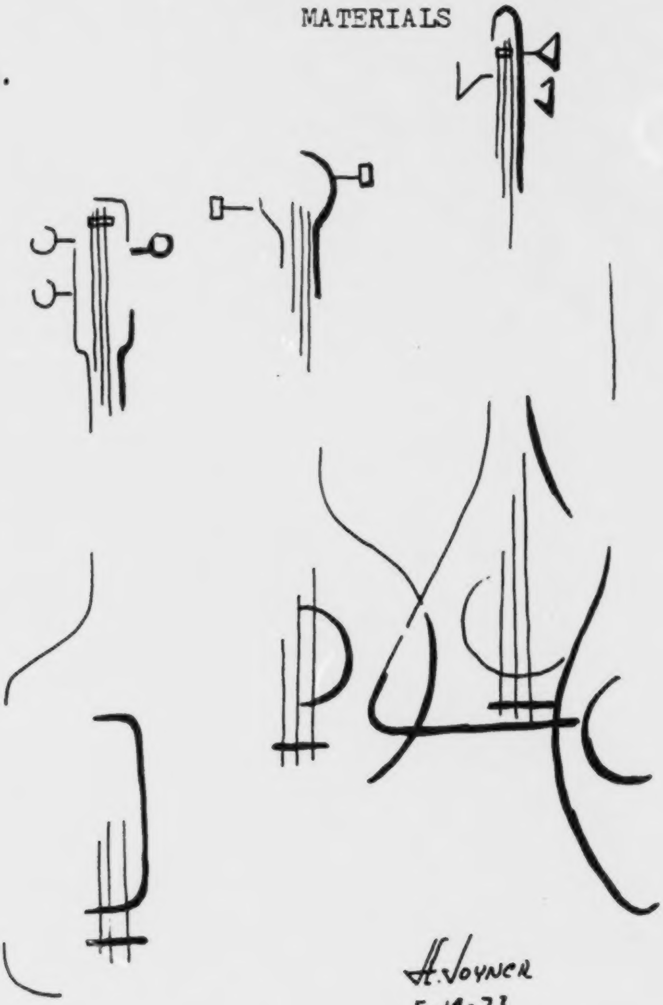
Design a wall plaque or plaques that would take the form of some type of musical instrument. Use the sheets provided to sketch your ideas. Be creative in your thinking.

LIMITATIONS

Wall plaque must be some type of musical instrument.

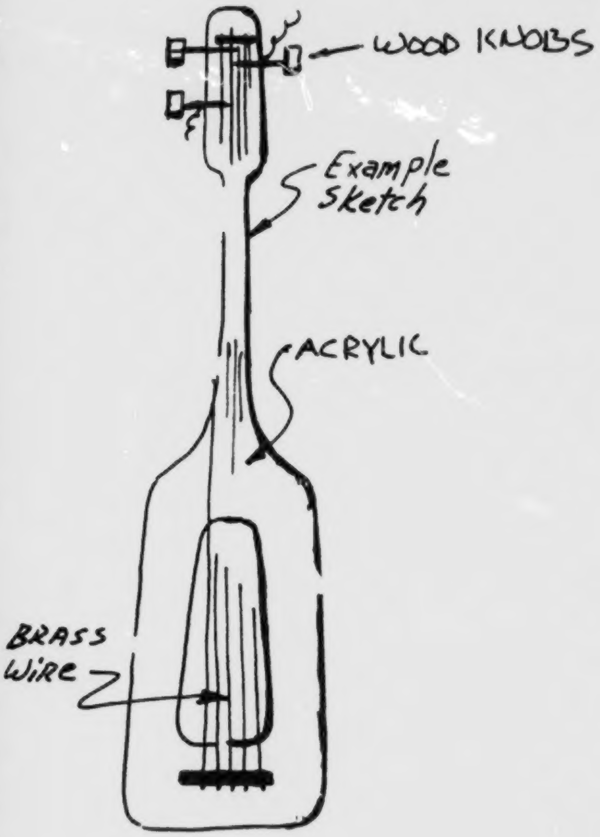
MATERIALS

Open.



H. Joyner
5-14-73

POSSIBLE SOLUTIONS


WOOD KNOBS
Example Sketch
ACRYLIC
BRASS WIRE

REFINED SOLUTIONS

FINAL SOLUTION

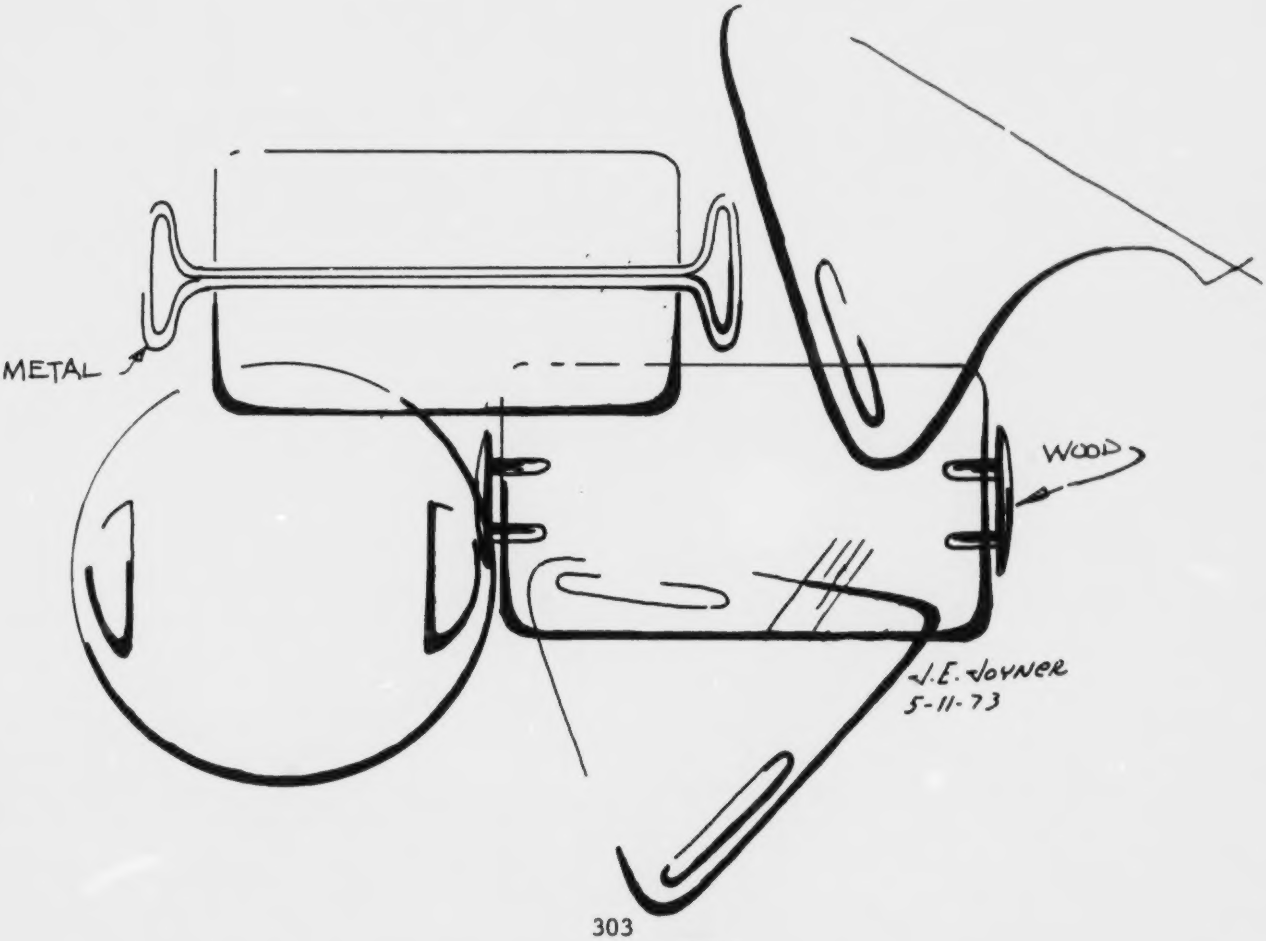
DESIGN

PROBLEM

Design a serving tray to be used in the home. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

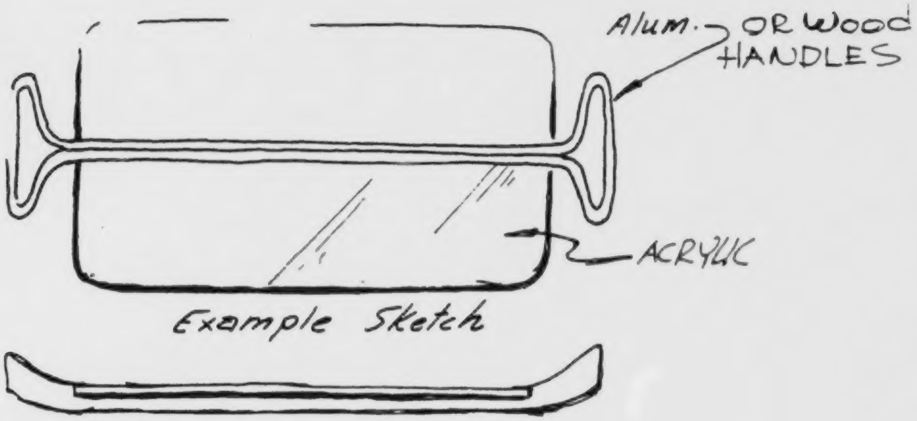
MATERIALS

Materials such as: wood, plexiglas, aluminium or cork could be used for this design.



J.E. Joyner
5-11-73

POSSIBLE SOLUTIONS


Alum. OR Wood HANDLES
ACRYLIC

Example Sketch

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

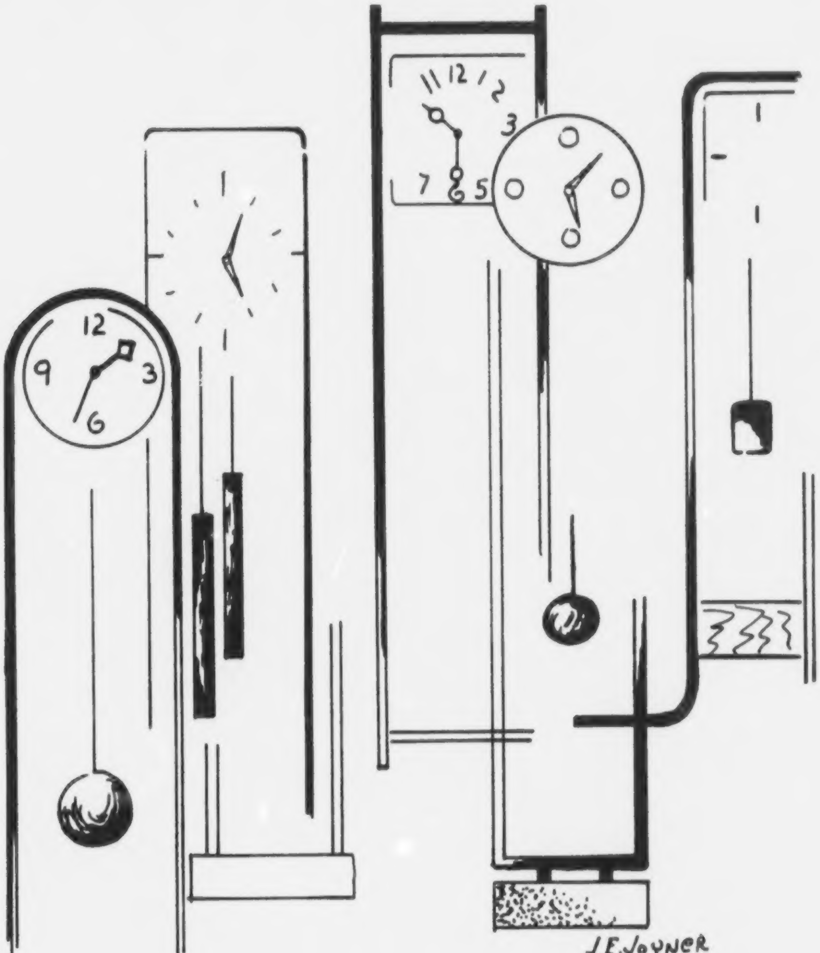
Develop a design for a contemporary grandfather's clock. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

The size of whatever clock movements used must be considered.

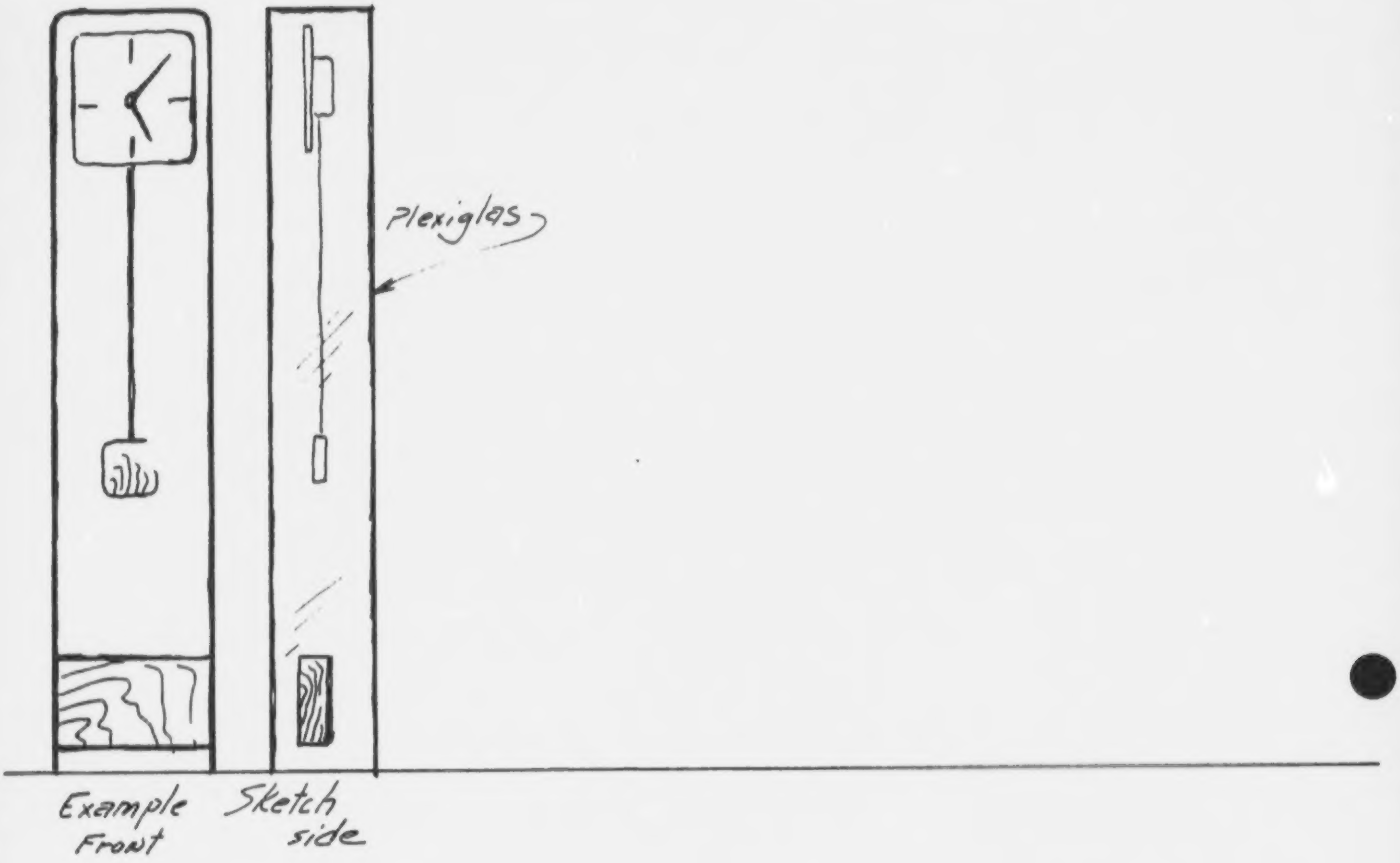
MATERIALS

A combination of plexiglas and wood or other materials could be used for this design.



J.E.JOYNER
5-11-73

POSSIBLE SOLUTIONS


Plexiglas
Example Front
Sketch side

REFINED SOLUTIONS

FINAL SOLUTION

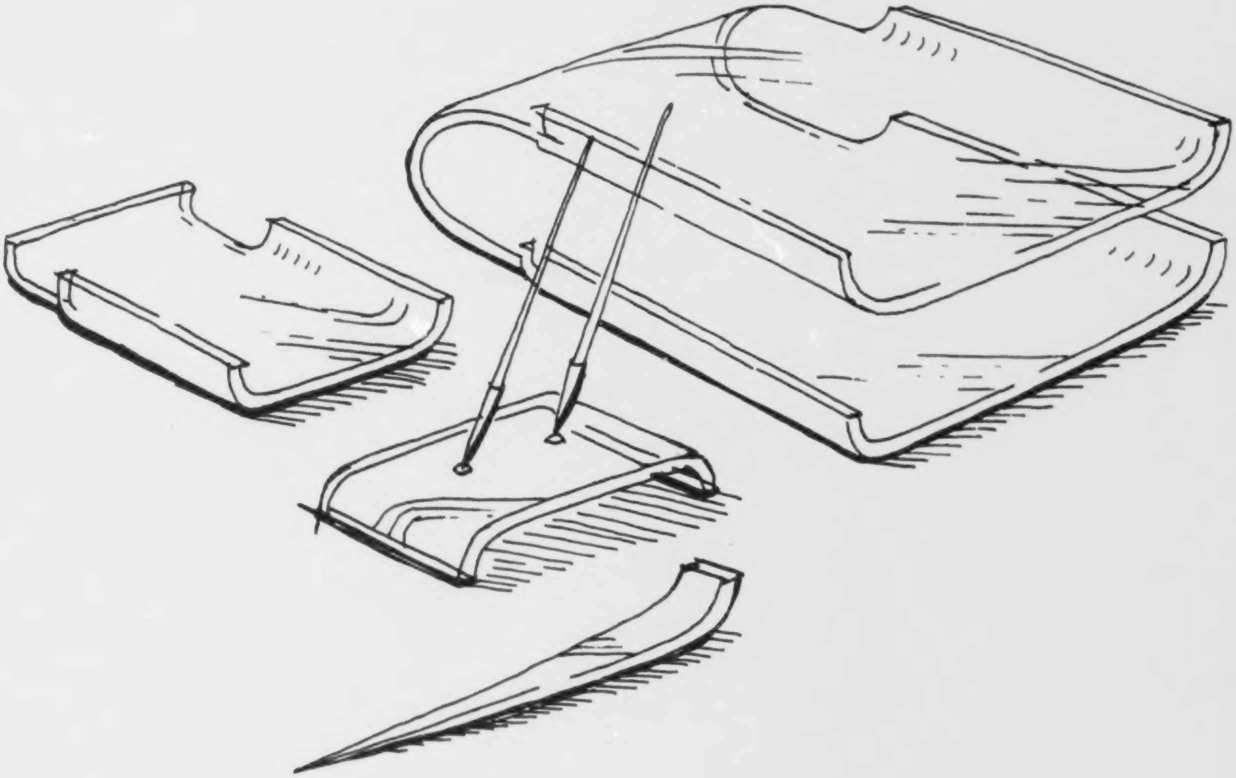
DESIGN

PROBLEM

Design a set of desk organizers to be constructed of acrylic. Design the paper holder, note pad holder, a two pen desk set and letter opener. Use the sheets provided to sketch and draw your ideas. Be creative in your thinking.

LIMITATIONS

Paper sizes must be considered and remember that the designs are to be constructed of 1/4" acrylic.



POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

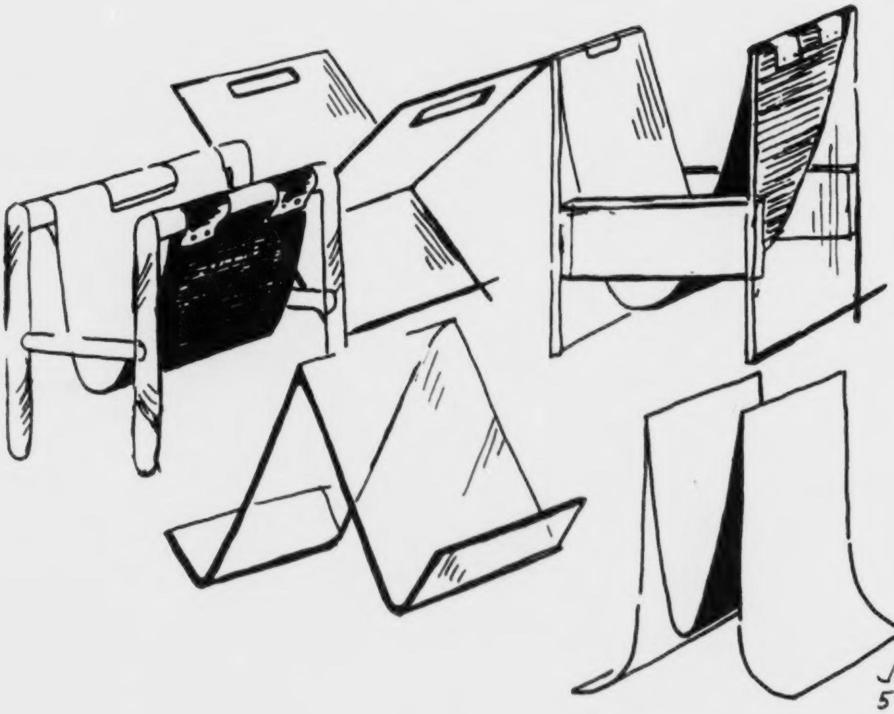
Design a device to store magazines when not in use. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

This device should hold at least six magazines.

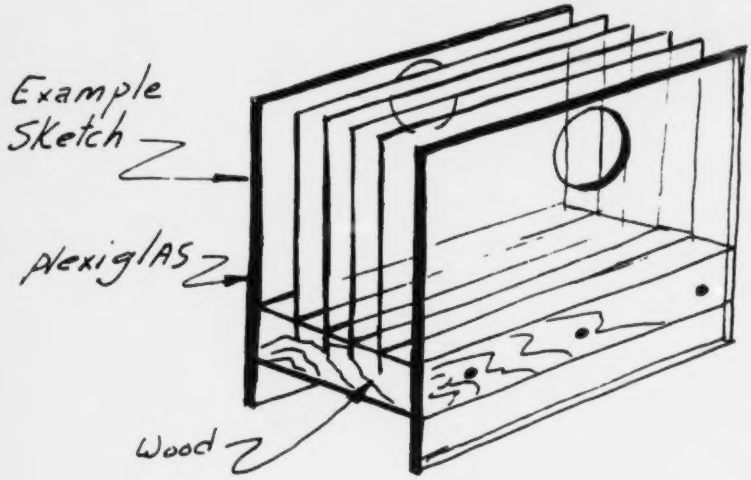
MATERIALS

Open.



J.E. Joyner
5-11-73

POSSIBLE SOLUTIONS


Example Sketch
plexiglAS
Wood

REFINED SOLUTIONS

FINAL SOLUTION

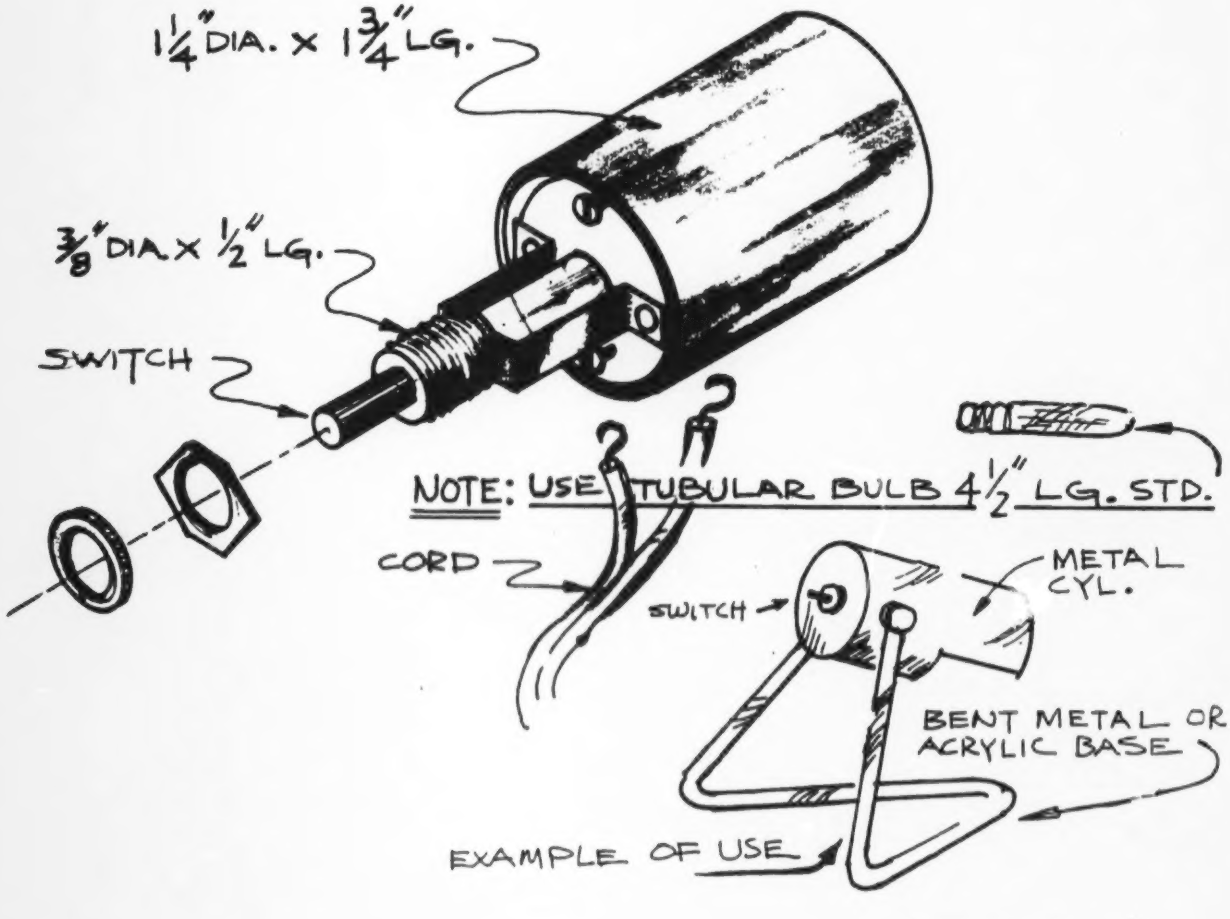
DESIGN

PROBLEM

Develop a design for a lighting device that could be used in a commercial or residential setting. Use the sheets provided to sketch and draw your creative ideas.

LIMITATIONS

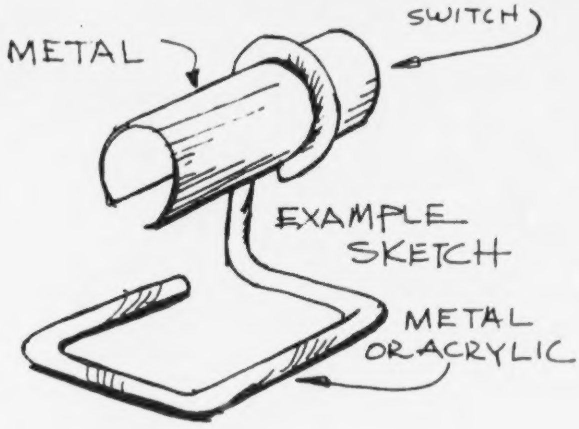
The standard lighting fixture, which is shown below must be used. A metal cylinder must be used for the shade but the base can be constructed of bent metal tubing,acrylic, rod or acrylic sheet. Use a standard 4½" tubular bulb.


1¼" DIA. x 1¾" LG.
3/8" DIA. x ½" LG.
SWITCH
CORD
SWITCH
METAL CYL.
BENT METAL OR ACRYLIC BASE
EXAMPLE OF USE

NOTE: USE TUBULAR BULB 4½" LG. STD.

JOYNER 79

POSSIBLE SOLUTIONS


SWITCH
METAL
EXAMPLE SKETCH
METAL OR ACRYLIC

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

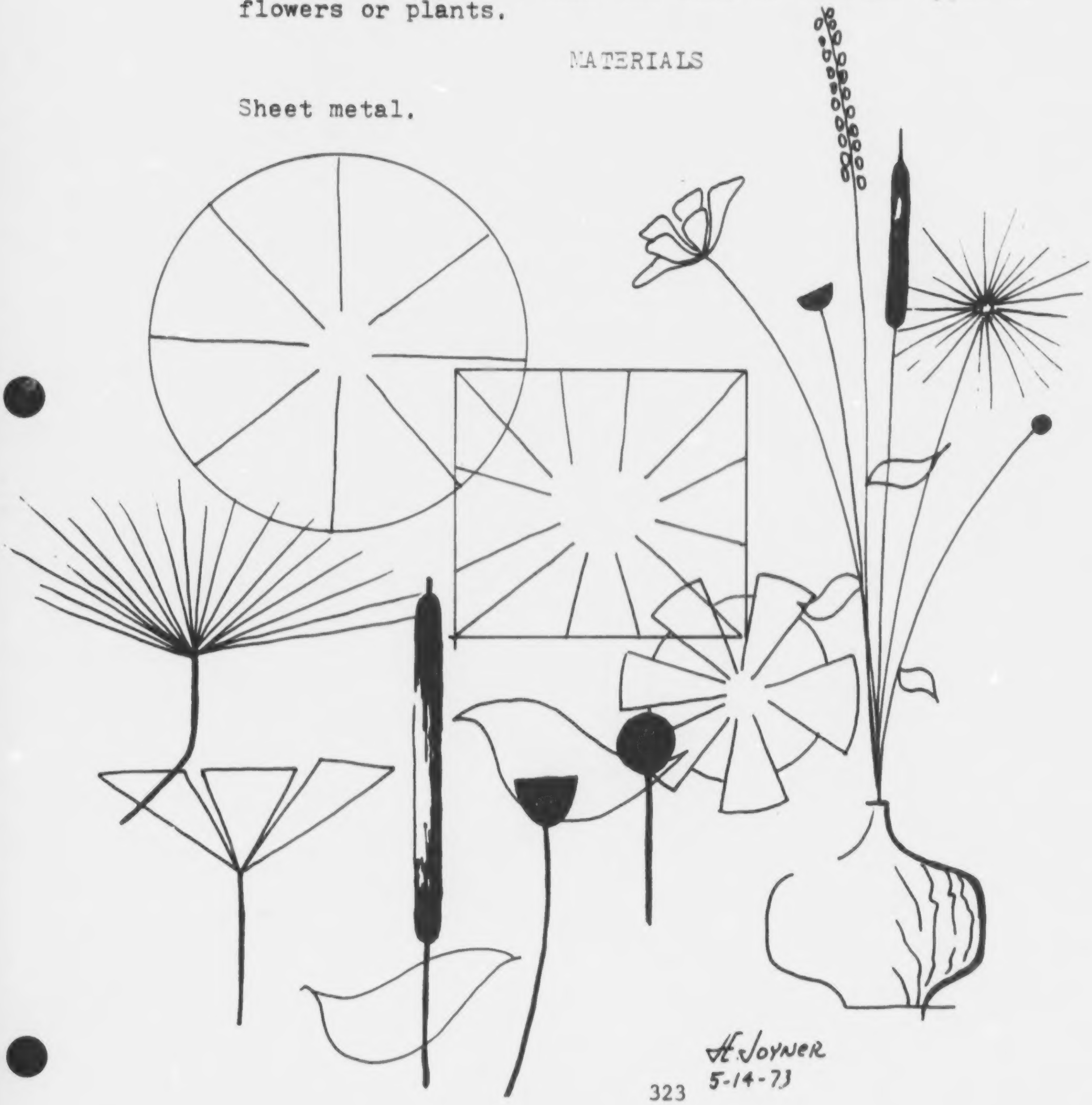
Design a sheet metal sculpture that would take the form of a flower arrangement and is suitable for use in the home. Use the sheets provided to sketch your ideas. Be creative in your thinking.

LIMITATIONS

This sculpture must take the form of various types of flowers or plants.

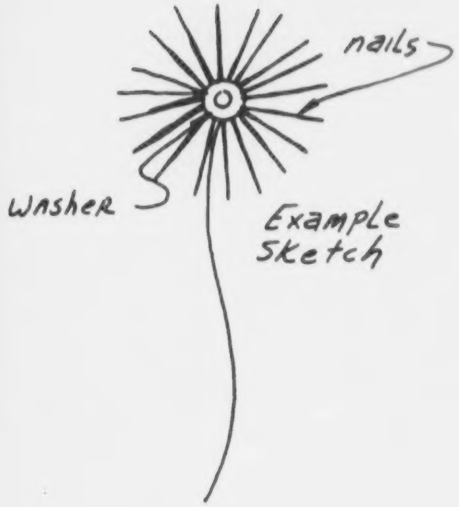
MATERIALS

Sheet metal.



H. Joyner
5-14-73

POSSIBLE SOLUTIONS


nails
Washer
Example Sketch

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

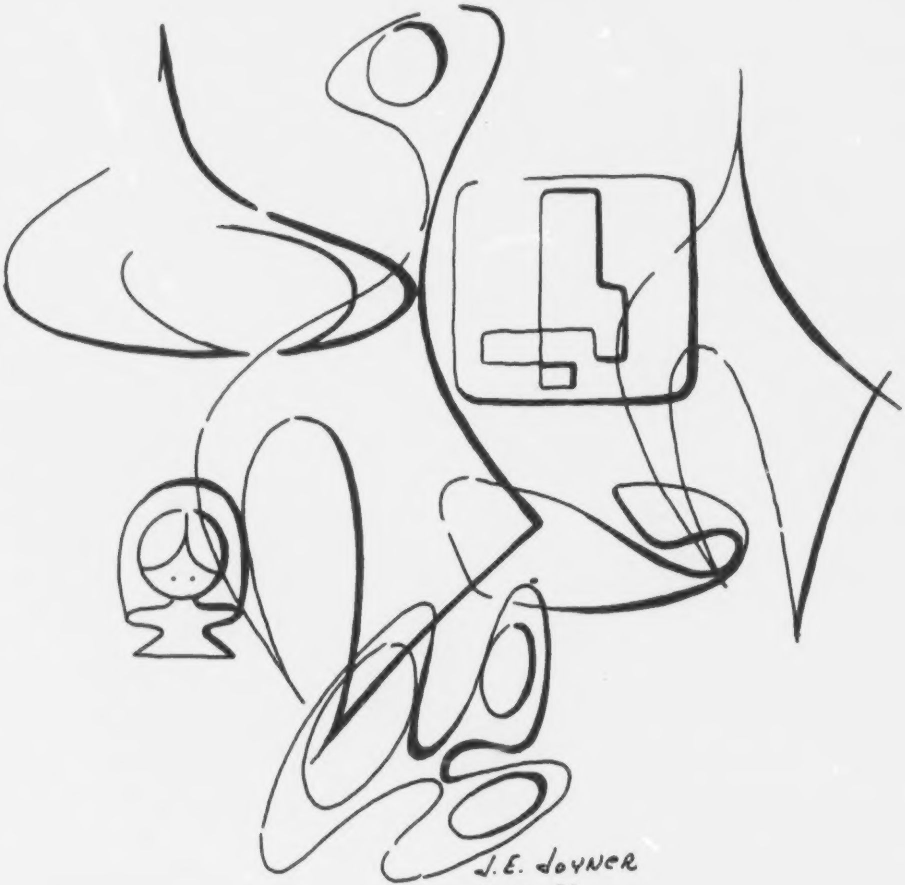
Design a piece of jewelry to be worn around the neck or pinned to a garment. Use the sheets provided to develop your ideas. Be creative in your thinking.

LIMITATIONS

The maximum size is 2" sq.

MATERIALS

Materials such as wood, plexiglas, metal or a combination of these could be used.



J.E. Joyner
5-10-73

POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

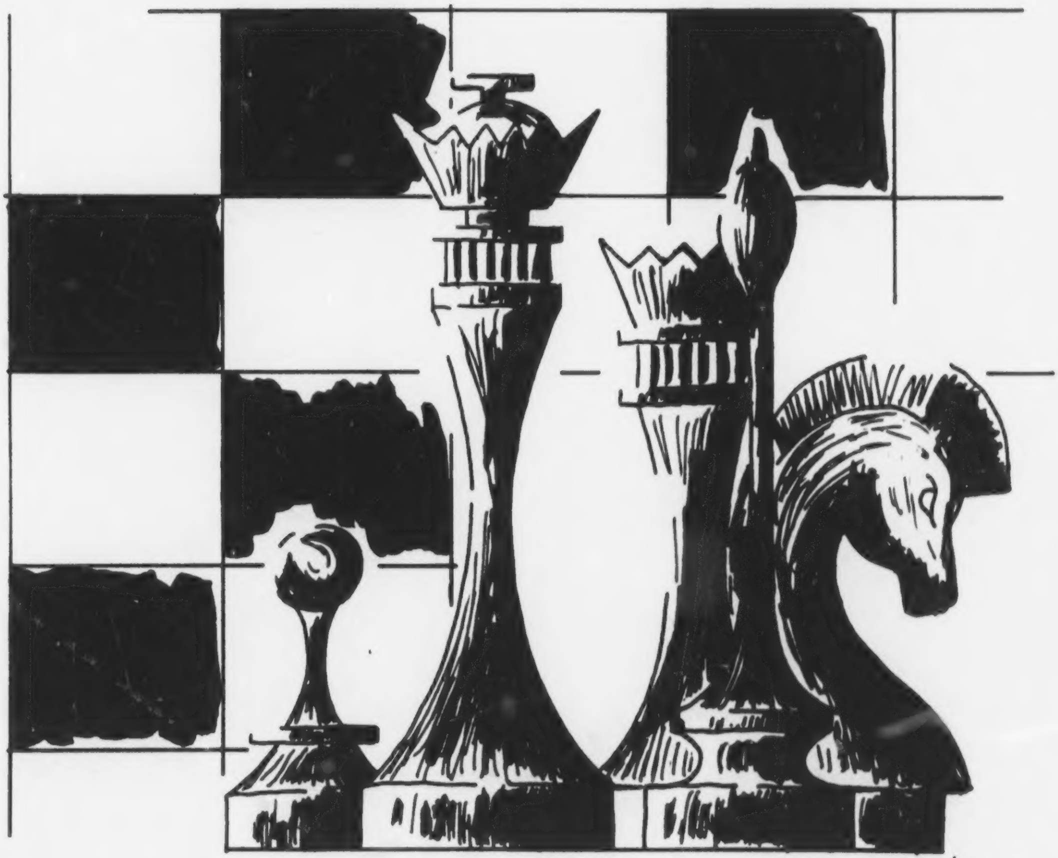
Design a chess set that is unique as well as functional. Remember, there are six different playing pieces. Use the sheets that are provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

The height of each different playing piece should be staggered and the base of each piece should be no larger than 1¼" sq. or 1¼" in diameter.

MATERIALS

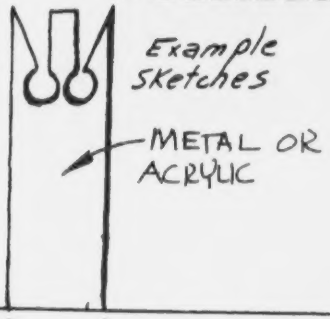
Open.



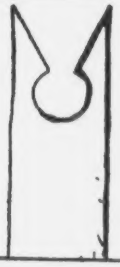
J.E. Joyner
5-10-73

BEST COPY AVAILABLE

POSSIBLE SOLUTIONS


Example sketches
METAL OR ACRYLIC

King



Queen

Rook

Bishop

Knight

pawn

REFINED SOLUTIONS

King

Queen

Rook

Bishop

Knight

pawn

FINAL SOLUTION

King

Queen

Rook

Bishop

Knight

pawn

DESIGN

PROBLEM

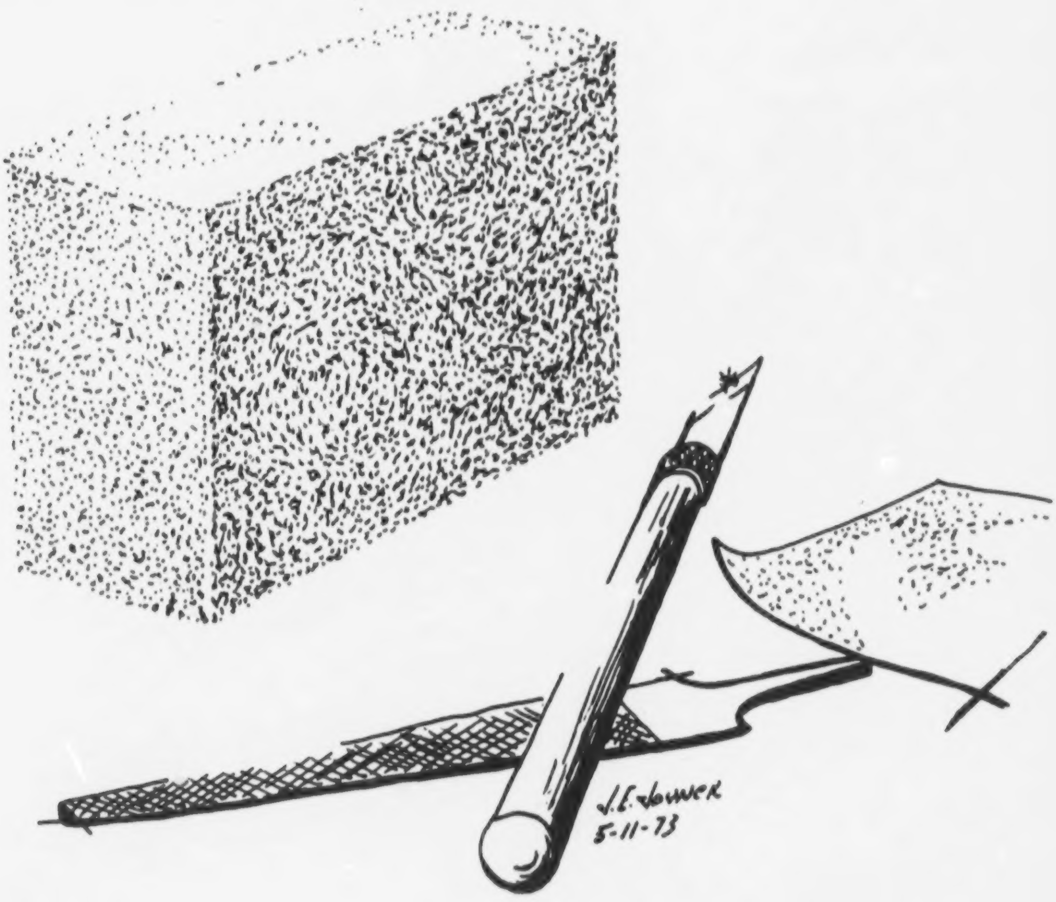
Using a piece of styrofoam that is approximately 2" X 8" X 8", develop a casting pattern that would be used in casting an article in aluminium. Use the sheets provided to design your chosen article. Be creative in your thinking.

LIMITATIONS

The maximum size of this design is approximately 2" X 8" X 8".

MATERIALS

Styrofoam and casting aluminium.



POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

The following is provided for you to develop and execute a particular design idea of your choosing. Choose an item for which you think there is a need and develop the design sketches for it. Be creative in your thinking.

Statement of the problem: In one complete and concise sentence state your problem. Indicate in the statement of the problem 1) What is to be designed, and 2) The function it is to fulfill.

"To design ____

____

____

____."

Joyner
5-19-73

II. Analysis of the Problem: Briefly record below your analysis of the problem. Be sure to include any limitation, which will affect your solution.

____

____

____

____

____

____

____

____

____

____

III. Research: Include below, and on the next two pages, any evidence of research you have conducted pertinent to this problem. Your research may be in the form of sketches, pictures taken from magazines and pasted on the sheet, etc. In all cases, note the source of your ideas.

POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

DESIGN

PROBLEM

Design a device that would hold an egg and would prevent breakage when dropped a distance of fifteen feet. After all designs are completed a contest will be held to determine the best design. Use the sheets provided to sketch your design solutions. Be creative in your thinking.

LIMITATIONS

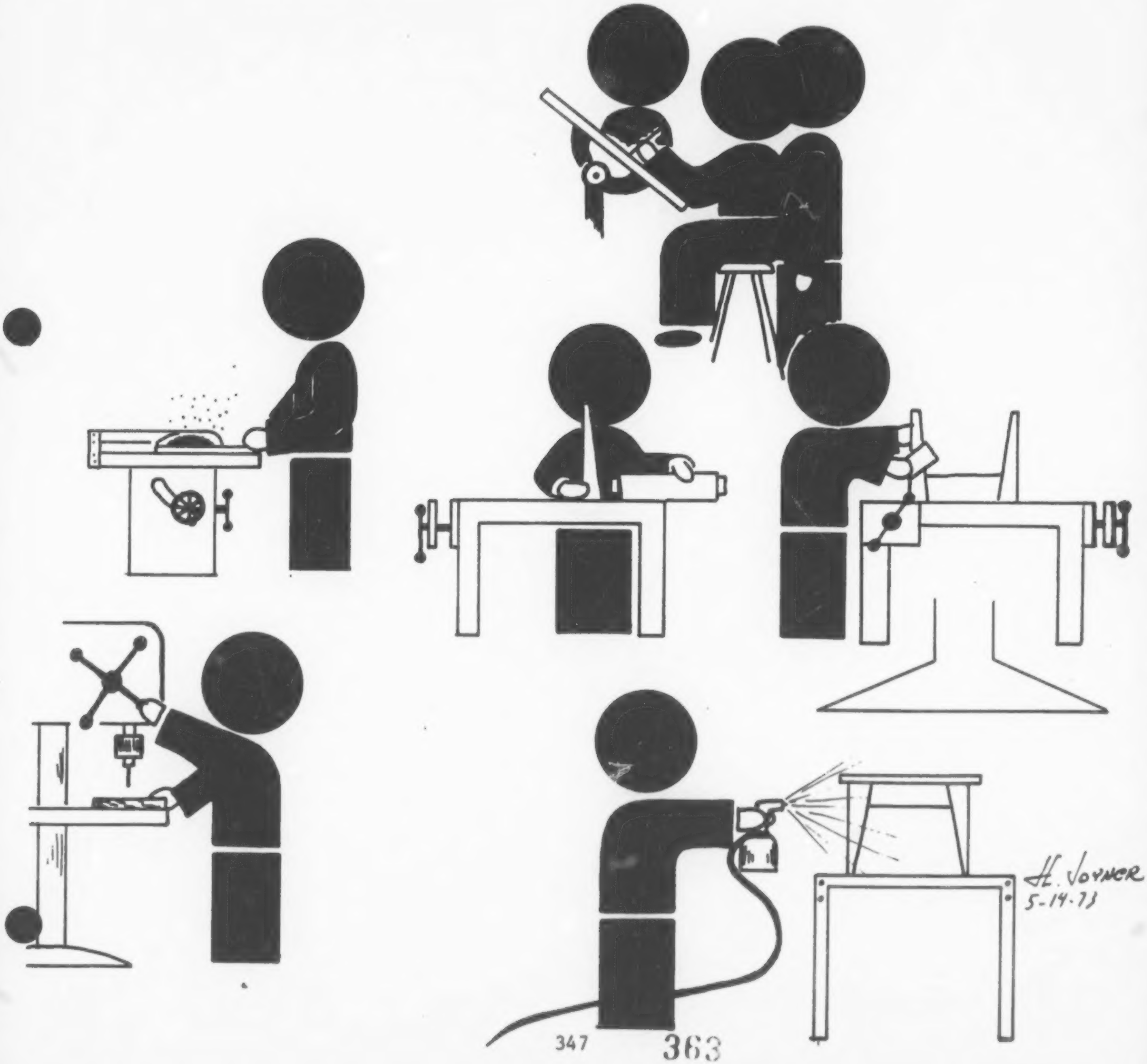
1. Plastic straws will be used in the construction.
2. No foam rubber can be used.
3. The maximum size of the device is 10" x 10".

H. Joyner
5-12-73

DESIGN

PROBLEM

The class will vote on an article that it would like to mass produce. A foreman should be chosen and each class member given a job with the responsibility of contributing to the finished product. Each class member will use the sheets provided to sketch design ideas for the chosen article to be mass produced. Be creative in your thinking. After the design phase has been completed, the class will choose what it feels is the best design.



H. Joyner
5-14-73

DESIGN

PROBLEM

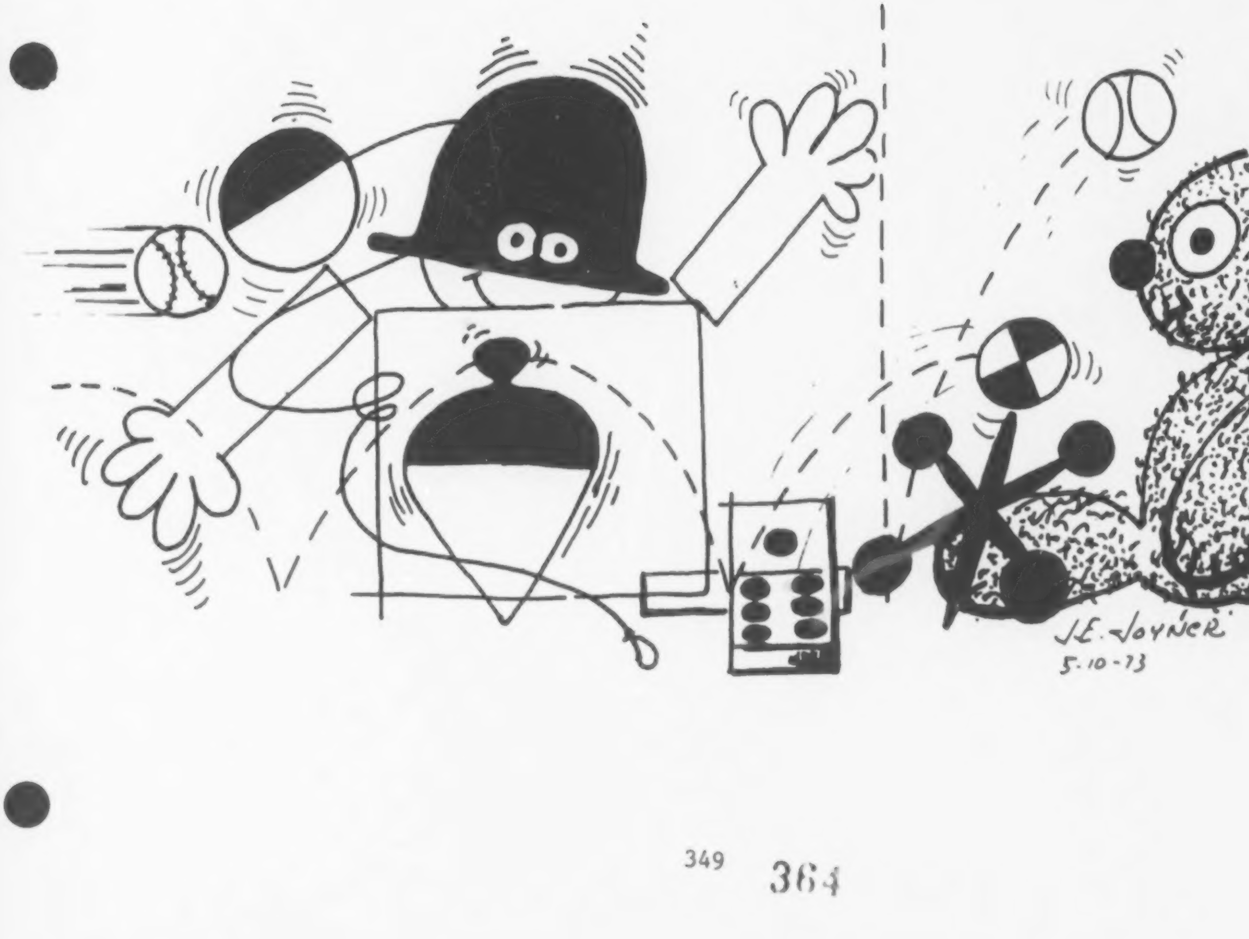
Develop a design for a unique toy. Use the sheets provided to sketch your design ideas. Be creative in your thinking.

LIMITATIONS

The toy is to be for a child between the ages of 5 and 10 years.

MATERIALS

Open.



J.E. Joyner
5-10-73

POSSIBLE SOLUTIONS

REFINED SOLUTIONS

FINAL SOLUTION

APPENDIX U

Evaluation

I. Design Problems

A. Idea Sketches - Fluency, Flexability, Originality, Elaboration

		Fluency	Flexability	Originality	Elaboration	
1.	Possible	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	___
2.	Refined	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	___
3.	Final			1 2 3 4 5	1 2 3 4 5	___

50 pts. possible, Total ___

B. Design Requirements

1.	Function	1 - 10	___
2.	Visual	1 - 10	___
3.	Material	1 - 10	___

30 pts. possible, Total ___

C. Final Presentation or Drawing

1.	Correct drafting practices	1 2 3 4 5	___
2.	Neatness and accuracy	1 2 3 4 5	___
3.	Dimensioning	1 2 3 4 5	___
4.	Rendering	1 2 3 4 5	___

20 pts. possible, Total ___

D. Parts List 1 - 10 ___

10 pts. possible, Total ___

E. Plan for Construction 1 - 10 ___

10 pts. possible, Total ___

Grand Total ___

		120 points possible
100% - 93%	A	120 pts. - 112 pts. = A
92% - 85%	B	111 pts. - 102 pts. = B
84% - 77%	C	101 pts. - 92 pts. = C
76% - 69%	D	91 pts. - 83 pts. = D

II. Rendering Problems

A. Drafting

1. Correct drafting practices	1 2 3 4 5	___
2. Neatness	1 2 3 4 5	___
3. Line values	1 2 3 4 5	___
4. Accuracy	1 2 3 4 5	___

20 pts. possible, Total ___

B. Illustration

1. Correct blending of tones	1 2 3 4 5	___
2. Clean sharp edges	1 2 3 4 5	___
3. Correct use of light	1 2 3 4 5	___
4. Contrast in tones	1 2 3 4 5	___
5. Neatness	1 2 3 4 5	___
6. Overall visual effect	1 2 3 4 5	___

30 pts. possible, Total ___

50 pts. possible, Grand Total ___

III. Technical Drawing Problems

A. Drafting

1. Correct drafting practices	1 2 3 4 5	___
2. Neatness	1 2 3 4 5	___
3. Line values	1 2 3 4 5	___
4. Accuracy	1 2 3 4 5	___

20 pts. possible, Total ___

B. Dimensioning

1. Line values	1 2 3 4 5	___
2. Correct dimensioning practices	1 2 3 4 5	___
3. Lettering	1 2 3 4 5	___
4. Neatness	1 2 3 4 5	___

20 pts. possible, Total ___

40 pts. possible, Grand Total ___

APPENDIX V

FOOTNOTES

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22. William J.J. Gordon, "Synetics" in *Training Creative Thinking,* Eds. Davis and Scott, p. 21.

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